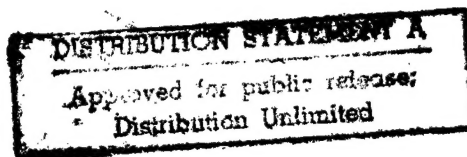


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JPRS-UBB-84-025

21 November 1984



# USSR Report

LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

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21 November 1984

USSR REPORT  
LIFE SCIENCES  
BIOMEDICAL AND BEHAVIORAL SCIENCES

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## AEROSPACE MEDICINE

### CLIMATE-CHAMBER EXPERIMENTS TO IMPROVE PILOTS' WORK CONDITIONS

Moscow VOZDUSHNIY TRANSPORT in Russian 2 Aug 84 p 3

[Abstract] The author reports on research and experiments which personnel of the State Scientific Research Institute of Civil Aviation (GosNII GA) have been conducting for the purpose of enabling commercial aviation pilots to cope better with stresses in prolonged flight. The scientists seek to accomplish this by modifying conditions which can adversely affect human work capacity during flight. Low air humidity inside an airplane is mentioned as one such condition. In the course of these studies, subjects are taking part in psychophysiological tests and experiments employing microclimate chambers with modeling of actual flight conditions. These methods make it possible to evaluate the subjects' performance of flight operations, study their condition thoroughly and monitor functional shifts occurring in their bodies in certain temperature-and-humidity conditions.

An account is given of one such experiment, which was conducted in GosNII GA's laboratory for the study of civil-aviation specialists' working conditions. The purpose of this experiment was to evaluate a subject's work capacity during a simulated eight-hour flight of an IL-62M airplane from Moscow to Petropavlovsk-Kamchatskiy. The relative humidity inside the 'pilot's cabin' was reduced to 10 percent during the simulated flight.

Special humidifiers have now been installed on IL-86 airplanes as a result of the scientists' recommendations, and the equipping of TU-154 and other airliners with humidification systems has been proposed. Science associates of the institute are said to be now studying effects of a constantly changing climate on human beings, the amount of work clothing that is suitable for Aeroflot specialists in various climatic zones, and other problems.

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CONTRIBUTION OF MINERAL FERTILIZER INDUSTRY TO FULFILLMENT OF USSR FOOD PROGRAM--IMPLEMENTATION OF DECISIONS OF 26th CPSU CONGRESS

Moscow KHIMIYA V SEL'SKOM KHOZYAYSTVE in Russian No 6, Jun 84  
pp 3-4

[Article\* by A. G. Petrishchev, Minister for Mineral Fertilizer Production]

[Text] In 1980, production of mineral fertilizers and chemical agents for plant protection was singled out as a separate sector of the national economy. At the present time, the ministry comprises 92 enterprises and the cost of the fixed industrial-production assets is about 25 billion rubles. In 1983, this sector manufactured products worth more than 10 billion rubles. The assortment of mineral fertilizers consists of virtually all types of products used in worldwide agriculture. The share of concentrated and complex fertilizers reached 85%.

A large scientific potential has been formed in this sector. There are 25,000 scientists and designers employed in 15 institutes. The fertilizer industry is developing on the basis of the latest advances in science and technology. Ammonia, carbamide, ammonium nitrate and sulfuric acid are produced primarily by high-output machinery. The economic indicators of performance of such installations are 20-30% higher than traditional ones previously used at the enterprises.

The share of the ministry in overall number of people employed in the industry is less than 1%, while output per worker is 1.5 times more. This level of development became possible as a result of allocation by the state of enormous funds for construction of new enterprises and remodeling of existing ones. A total of 70-80 major enterprises are started up each year.

Use of chemistry in plant growing and livestock breeding made it possible to obtain additional agricultural products worth 18.5 billion rubles under the 10th Five-Year Plan. Thanks to the use of mineral fertilizers, 38 million more tons of grain, 3 million more tons of cotton and more than 10 million more tons of sugar beets were produced.

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\*Paper (published in somewhat abridged form) delivered on 30 March 1984 at the Moscow Scientists' House at a meeting of workers in the chemical industry, USSR Gosplan with scientists of the USSR Academy of Sciences and sectorial institutes.

Already in 1980, the increased deliveries of pesticides made it possible to treat 160 million ha of farm land. This helped save the harvest and reduce significantly the labor involved in raising and processing it.

The efficacy of mineral fertilizers and chemicals for plant protection is expressed not only as an increase in harvest and preservation of products, but significant growth of labor productivity in agriculture. This is evident from the following, for example. On our planet, agricultural labor productivity increased by 60% from 1900 to 1940, and in the next 40 years, by 1980, it increased by 11 times with extensive use of chemicals. It would be impossible at the present time and in the future to furnish foodstuffs to mankind without involvement of the chemical industry in agricultural production.

To fulfill the Food Program, it will be necessary to invest 30 billion rubles by 1990 for development of mineral fertilizer production. Even on the scale of the entire national economy this is an extremely large sum. But the above-mentioned expenses are a pressing necessity. Economists and scientists have determined that use of chemicals should provide for half the increase in agricultural production. Thus, exceptionally high responsibility has been placed on the Ministry of Mineral Fertilizer Production.

There are several problems in this sector. We shall discuss some of the major ones.

In our country, 80% of all farmed land is inherently very poor in phosphorus. Yet it is known that the size of the harvest depends on nutrients, which must be present in a minimal quantity. This is a law of biology. In spite of the enormous funds for development of the phosphorus fertilizer industry, it is still not possible to supply them to agriculture in the required quantities. The main cause is a disproportion between available capacities for production of phosphorus fertilizers and availability of raw materials.

"Khibinskiye" apatites are the main source of raw materials for phosphate production. We produce virtually 80% of all phosphorus fertilizers in the nation on their basis. But the deposits on Kola Peninsula are becoming depleted, and the amount of basic substance in the apatites is diminishing. Even now, in order to maintain the previous level of recovery of basic substance, additional expenses must be incurred. For this reason, it is necessary to develop (and discover) other phosphate mines. There are quite a few in our country, but the quality of their ore is considerably inferior to the deposits on Kola Peninsula. It is expensive to work these mines, and to enrich phosphorous raw material when processing it new methods are needed. An intensive scientific search is needed to find the optimum solutions for these problems.

We do not meet in full the needs of agriculture with regard to other types of mineral fertilizers either, as well as pesticides, although the rate of development of fertilizer production was 2-3 times faster than growth of agricultural production as a whole for the last three 5-year plan periods. We must augment significantly the output of fertilizers and chemical agents for plant protection. At the present time, the assortment of the latter is quite limited: together with CEMA nations, we produce slightly more than 100 agents. And the efficacy of using them is constantly diminishing (when

the same agents are used for a long time, insects and plants develop immunity). Development of industrial methods of raising agricultural cultivars is being delayed because of the pesticide shortage. It is necessary to renew the assortment of chemicals for plant protection. Some work is being done in this direction, and we shall expand it. A decision was made to call upon chemical institutes of the Academy of Sciences to participate in development of pesticides and technologies for new agents.

The quality of training future specialists in plant protection should be improved. This is a mandatory prerequisite for improving the efficacy of chemical plant protection and reducing to a minimum its adverse effect on the environment.

As has been stressed at all forums of our party, economy and carefulness are one of the directions of technological progress. The mineral fertilizer production sector is a major consumer of energy in our country. Introduction of advances in science and technology, as well as the knowhow we have gained, has taught us to be economical in using energy. In 1983, the increase in use of all forms of energy constituted less than 0.5% per 1% increase in volume of industrial production, but even this is too much. Serious steps are needed to reduce fuel consumption.

Wise use of technical resources is one of the criteria that presently determines the possibility of developing the industry, as well as development of technological processes, in which there would be scientific validation of the combination of technical level of production and energy consumption.

Our sectorial institutes, together with many Academy institutes, are working on 19 integrated special-purpose programs; they are working out 37 programs to solve the most important problems of science and technology. However, in order to accomplish all of this, the ties with the USSR Academy of Sciences must become even closer. We are confident that this meeting will give new impetus to strengthening and broadening collaboration between researchers of sectorial institutes and scientists of the USSR Academy of Sciences.

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CSO: 1840/1082

CARBOBIURET CYANURPHOSPHATE, NEW CONSTITUENT OF MIXED FEED

Moscow KHIMIYA V SEL'SKOM KHOZYAYSTVE in Russian No 6, Jun 84  
pp 50-52

[Article by I. P. D'yakov, candidate of agricultural sciences, V. I. Zotkin and V. A. Perelygin (All-Union Scientific Research Institute of the Mixed Feed Industry)]

[Text] In recent times, increasing use is being made in livestock breeding of synthetic substances containing several elements essential to animals. Such complex feed supplements are an important source of enrichment of the diet with nitrogen, phosphorus, calcium, sulfur and other macroelements and trace elements. Carbobiuret cyanurphosphate (CBCP), which was proposed by the Dzerzhinsk Affiliate of GIAP [State Scientific Research and Planning Institute of the Nitrogen Industry and Products of Organic Synthesis].

CBCP is a nitrogen and phosphorus supplement that is recovered from products of polycondensation of carbamide and ammonium phosphate. It is intended for ruminants in the place of carbamide. CBCP is put out in the form of white or grayish granules up to 3 mm in diameter and 10 mm in length. The composition of the supplement varies, depending on production conditions. On the average, CBCP contains 25-45% carbamide, 17-37% biuret, 27-40% ammonium polyphosphate and 3-9% cyanuric acid. Animal experiments established that, because of the significant levels of biuret and cyanuric acid in CBCP, ammonia is released from CBCP in the rumen relatively slowly, as a result of which better conditions are formed for synthesis of microbial protein than with use of pure carbamide. However, there is still insufficient information on the use of CBCP in the diet of ruminants, or about use of a supplement in mixed feed, while the most effective route of using synthetic nitrogen substances (SNS) is expressly to add them to mixed feed.

For this reason, we investigated the technological properties and modes of adding CBCP to mixed feed, as well as efficacy of giving the supplement as part of mixed feed for young cattle being fattened.

The study was conducted using an experimental batch of CBCP of the following composition: carbamide 41.3%, biuret 15.3%, ammonium polyphosphate 38.3% and cyanuric acid 5.1%. The supplement contained 33.6% total nitrogen, including 25.6% in the amide form. Moisture content of the product was 0.3%.

Table 1. Composition of mixed feed prepared with different forms of SNS

Indicator	Mixed feed for animals in group		
	I	II	III
Components, %			
Barley	25.5	37.0	35.0
Corn	10.0	10.0	10.0
Oats	10.0	10.0	10.0
Wheat bran	15.0	25.5	20.0
Soybean oil cake	25.0	6.0	8.0
Grass meal	12.0	12.0	12.0
Carbamide	--	2.0	--
CBCP	--	--	2.5
Chalk	0.5	0.5	0.5
Salt	1.0	1.0	1.0
Premix	1.0	1.0	1.0
totals	100	100	100
Amounts per 100 kg mixed feed, %			
Feed units	109.3	104.2	104.3
Crude protein	19.4	19.6	19.6
Cellulose	8.5	8.7	8.6
Calcium	0.49	0.40	0.39
Phosphorus	0.50	0.47	0.51
Sodium	0.40	0.40	0.40
Cost of raw materials, rubles/ton	67.7	77.8	78.8
Wholesale mixed feed cost, rubles/ton	74.0	85.0	86.0

It was determined that CBCP has satisfactory technological properties. The quality of the product changes little when stored for 6 months in polyethylene bags in a stack, and looseness decreases only to 92%. The Dzerzhinsk Affiliate of GIAP suggested that the friability of CBCP be increased.

CBCP dissolves poorly in molasses, forming a gel-like mass, so that it is recommended to add the product in dry form in bulk and granulated mixed feed, and only in bulk mixed feed as part of the carbamide concentrate. Granulation should be performed under the following conditions: steam pressure  $3 \cdot 10^5$ – $4 \cdot 10^5$  Pa, temperature of steamed mix 50–60°C, moisture of steamed mix 14.5–16%, steam delivery rate 25–40 kg/ton. Mixtures with 20–25% CBCP can be extruded at temperatures of 125–145°C (at output from extruder).

Three batches of mixed feed were produced at the Voronezh Experimental Mixed Feed Plant for zootechnical tests to investigate the efficacy of CBCP used as part of mixed feed for young cattle: 1) control, formula No K63-2 with soybean oil cake, 2 and 3) experimental, formula calculated on a computer with addition of carbamide and CBCP. All of the mixed feed was granulated and was virtually the same in levels of basic nutrients, but because of the difference in cost of oil cakes and SNS, the prices were not the same (Table 1).

Table 2. Effect of mixed feed with different forms of SNS on results of fattening young cattle

Indicator	Animal group		
	I	II	III
Research farm experiment			
Live weight per head, kg, at start of experiment	331.8	331.0	325.6
at end of experiment	417.8	414.5	411.9
Gain in experiment, kg	86.0	83.5	86.3
Mean daily gain, g	860±24.1	835±27.9	863±25.6
Feed outlay per q gain, q feed units	8.32	8.33	8.06
mixed feed, q feed units	5.06	4.98	4.82
Total feed cost per q gain, rubles	55.5	62.5	60.9
mixed feed, rubles	34.4	40.7	39.8
Dressed yield, %	54.9	54.6	54.9
Muscle and fat content, %	81.7	82.0	87.7
Bone content, %	18.3	18.0	18.3
Production experiment			
Live weight per head, kg, at start of experiment	317.1	318.7	318.7
at end of experiment	396.0	395.9	397.8
Gain in experiment, kg	78.9	77.2	79.1
Mean daily gain, g	789.0	772.0	791.0
Feed outlay per q gain, q feed units	9.06	9.01	8.79
mixed feed, q feed units	5.52	5.38	5.25
Total feed cost per q gain, rubles	60.5	67.6	66.4
mixed feed cost, rubles	37.4	44.0	43.5

The mixed feed with the soybean oil cake was the cheapest (74.0 rubles/ton), and wholesale prices for mixed feed with carbamide and CBCP were 85.0 and 86.0 rubles/ton, respectively.

A scientific experiment to test the efficacy of CBCP in mixed feed was conducted at the Podgornoye Kolkhoz in Ramonskiy Rayon, Voronezh Oblast, on three groups of young cattle being fattened (10 head in each group) for 100 days. The animals in group I were given mixed feed with soybean oil cake, the ones in groups II and III, with carbamide and CBCP, respectively. In addition to this experiment, the same protocol was used in a production test on a larger number of cattle.

The diets were planned monthly according to VIZh [All-Union Scientific Research Institute of Livestock Breeding] standards. They were virtually the same in total nutritional value and levels of basic nutrients. In addition to mixed feed, the diet included 1 kg chaff hay, 10 kg corn silage and 10 kg beet pulp. On the whole, during the period of the experiments, about 30% of the digestible protein requirements of animals in groups II and III were satisfied with SNS nitrogen.

The results of the experiments revealed that the mean daily live weight gain per animal in groups I and III was virtually the same (860 and 863 g), but it was somewhat lower in group II, 835 g (Table 2). Feed outlay in amount and cost per q weight gain in groups of animals given mixed feed with CBCP was 2.6-3.3% less in the research farm experiment and 1.8-2.5% in the production experiment than in groups of animals given mixed feed with carbamide in pure form. The higher weight gain and better return on the feed with use of CBCP (as compared to pure carbamide) are attributable to slower release of nitrogen in the rumen, as well as the phosphorus present in the supplement, which has a beneficial effect on biosynthetic processes in the animals' stomach.

The third group of animals were superior to even the first group in return on feed in the form of weight gain. But, because of the lower wholesale price of oil cakes and grist, the feed cost per quintal gain was lowest in the first group given soybean oil cake as source of protein. Of course, this does not minimize the value of CBCP, since there is an acute shortage of oil cakes and grist.

There were no appreciable differences between animal groups with regard to butchering and meat quality.

Digestibility of nutrients was quite high and virtually the same in all groups of animals. We can merely mention a tendency toward better digestibility of nutrients in groups I and III. Nitrogen balance was positive, but the first and third groups of animals utilized somewhat more of this element.

The hematological parameters were in the physiological range in all animals. Maximum blood urea content (27.0 mg%) was found in group I and minimum (21.0 mg%) in group III. There was a distinct pattern in blood ammonia level: 0.214 mg% in blood of animals in the first group, 0.354 and 0.315 mg% in the second and third, respectively. All of the physiological parameters--body temperature, pulse rate, respiration and ruminal contraction per minute--changed consistently in all groups before and after feeding, and they were in the normal range.

We also failed to demonstrate appreciable differences between groups in levels of dry substance, protein and urea in the dorsal longissimus and deep gluteal muscles. At the same time, there was considerably more fat in muscles of animals in group II and particularly group III.

The difference between groups in total demonstrated amino acids in the dorsal longissimus and deep gluteus muscles is insignificant: 547.8, 561.5 and 553.1 g/kg air-dried muscle. However, the parameters were best in the first group for such extremely important amino acids as lysine, methionine and cystine.

The results of these studies lead us to conclude that feeding young cattle mixed feed with CBCP yields a somewhat greater mean daily live weight gain than mixed feed with pure carbamide. As compared to pure carbamide, CBCP is less toxic and it can be used extensively at large livestock farms.

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## PRODUCTION ASSOCIATION WINNERS OF SOCIALIST COMPETITION IN 1983

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84

p 4

[Text] The workers in production associations of Sel'khozkhimiya [Agrochemical Services to Agriculture], who participated in the socialist competition for fulfillment and overfulfillment of tasks under the 11th Five-Year Plan have made new achievements in labor. Through the efforts of mechanized detachments, 504 million tons of organic fertilizers were delivered to the fields, 367 million tons of such fertilizers were applied to the soil, cultivars covering an area of 33 million ha were treated with mineral fertilizers, soil over an area of 7.2 million ha was treated with lime and gypsum, crops were treated with pesticides over an area of 21 million ha, 68 million tons of peat was recovered for use as fertilizer and litter in barns, and airborne chemical spraying of 34 million ha was performed as services by Sel'khozkhimiya associations. As compared to 1982, the volume of agrochemical work increased by 6.8% and reached a cost of 1.7 billion rubles. The transport resources of the associations hauled 332 million tons of mineral and organic fertilizers and chemicals for soil improvement, agents for protection of plants and other agricultural freight. Kolkhozes and sovkhoses have utilized various chemicals worth a total of 6.1 billion rubles.

There was further combined agrochemical improvement of fields, which resulted in an average of 30-40% increase in harvests; there was expansion of introduction of progressive methods for using fertilizers and pesticides--band method and root application, as well as small-volume spraying. There was intensification of the role of socialist competition in developing creative activity of machine operators, agrochemists, specialists in plant protection, as well as mobilization of worker groups to utilize reserves for improving the effectiveness and quality of agrochemical work.

A total of 30 production associations of Sel'khozkhimiya were victors in the 1983 All-Union Socialist Competition, and they were awarded the Challenge Red Banners of the CPSU Central Committee, USSR Council of Ministers, AUCCTU [All-Union Central Council of Trade Unions] and Komsomol [All-Union Leninist Communist Youth League] Central Committee. The following associations were rated as the best: in the RSFSR--Ilishevskiy (Bashkir ASSR), Baksanskiy (Kabardino-Balkar ASSR), Lyambirskiy (Mordovian ASSR), Nazranovskiy (Chechen-Ingush ASSR), Novoselovskiy (Krasnoyarsk Kray), Apanasenkovskiy (Stavropol Kray), Novousmanovskiy (Voronezh Oblast), Shatkovskiy (Gorkiy Oblast),

Nerekhtskiy (Kostroma Oblast), Borinskiy (Lipetsk Oblast); in Ukrainian SSR--Manevichskiy (Volyn Oblast), Galichskiy (Ivano-Frankovsk Oblast), Boguslavskiy and Kievo-Svyatoshinskiy (Kiev Oblast), Lebedinskiy (Sumy Oblast), Lozovskiy (Kharkov Oblast); in Belorussian SSR--Baranovichskiy (Brest Oblast) and Nesvizhskiy (Minsk Oblast); in Uzbek SSR--Vabkentskiy (Bukhara Oblast) and Urgutskiy (Samarkand Oblast); in Kazakh SSR--Alakulskiy (Taldy-Kurgan Oblast) and Shcherbaktinskiy (Pavlodar Oblast); in Georgian SSR--Zugdidskiy; in Azerbaijan SSR--Agdzhahedinskiy; in Lithuanian SSR--Radvilishkiskiy; in Moldavian SSR--Slobodzeyskiy; in Latvian SSR--Balvskiy; in Kirghiz SSR--Naukatskiy (Osh Oblast); in Armenian SSR--Martuninskiy; in Turkmen SSR--Chardzhouskiy (Chardzhou Oblast).

In rating the results of the competition, consideration was given to fulfillment of plans and contractual obligations, return in harvest from mineral fertilizers, growth in output of plant-growing products in serviced farms, reduction in their cost, improvement of work quality, savings of fuel and energy resources.

Among the winners of the competition special mention should be made of the Kievo-Svyatoshinskiy Rayon Association under Ukrsel'khozkhimiya [Ukrainian Sel'khozkhimiya], which has retained the Challenge Red Banner for 3 years.

In 1983, the overall volume of work performed by the workers of this association (expressed as cost) increased by 12.8%, as compared to 1982; it increased by 14% in pesticide use and 38% in lime treatment of soil. The Rayon Sel'khozkhimiya does 80% of the work to transport organic fertilizers, 70% of the work to apply them in the soil, 50% to apply mineral fertilizers, 30% of the work for control of pests, plant diseases and weeds. Agrochemical services are performed mainly in an integrated manner, in accordance with technological plans, and primarily in economically poor farms. Thanks to the endeavors of Sel'khozkhimiya, green mass yield from corn increased by 197 q/ha at the Buchanskiy Sovkhoz, cucumber harvest increased by 95, feed beets by 90 q/ha; at the Muzychanskiy and imeni 60th Anniversary of October sovkhozes, 633 and 576 q/ha, respectively, of feed beets were harvested per hectare. Proper organization of work and exemplary upkeep of equipment made it possible to achieve coverage of 2305 ha with each conventional standard tractor and to save 58.5 tons of diesel fuel. Labor productivity increased by 8%, with an average 1% increase in wages.

The Nesvizhskiy Rayon Association of Belsel'khozkhimiya [Belorussian Sel'khozkhimiya] completed the third year of the five-year plan well. Through its efforts, 211,000 tons organic fertilizers were applied in the soil, mineral fertilizers were applied to 42,500 ha, pesticides were used over an area of 39,500 ha, which is 44% more than in 1982. Output per conventional standard tractor increased by 2% and labor productivity by 4%. There was an increased output of agricultural products; this rayon fulfilled the plan for selling grain to the state by 103.2%, meat by 111% and milk by 103.8%.

All of the agrochemical work, including plant protection (worth a total of 5.9 million rubles) was done in Slobodzeyskiy Rayon of Moldavia by 28 mechanized detachments of the rayon's Sel'khozkhimiya association. As a result of prompt and proper control of pests and plant diseases in the interkolkhoz Pamyat' Il'ichu [in memory of Lenin] Orchard, 203 q/ha fruit was harvested; 332 and

299 q/ha vegetables were harvested in the serviced kolkhozes imeni Lenin and imeni Michurin, respectively. The association has achieved high technical and economic indicators: output per conventional standard tractor increased by 30% and labor productivity by 15%.

For 3 successive years, the Naukatskiy Rayon Association of Kirgizsel'khozkhimiya [Kirghiz Sel'khozkhimiya] has held first place in this republic's competition and is retaining the Challenge Red Banner of the CPSU Central Committee, USSR Council of Ministers, AUCCTU and Komsomol Central Committee. In 1983, the volume of work it performed increased, in comparison to 1982, by 12% for transportation of organic fertilizers, by 31% for treatment of crops with pesticides and servicing farm aviation, by 6% for use of mineral fertilizers and chemicals for protection of plants. Output per conventional standard tractor increased by 37% and labor productivity by 6%.

There were also 35 rayon associations that were victors in the All-Union Socialist Competition, and they were awarded the Challenge Red Banners of the USSR Ministry of Agriculture and Central Committee of the Farm Workers Trade Union, and the first cash prizes.

Ten collectives at supply bases, motor vehicle enterprises and associations of Sel'khozkhimiya received second and third cash prizes. Challenge Red Banners of the Komsomol Central Committee were given to the workers of the Komsomol mechanized youth detachments of the Yegoryevskiy Rayon Association of Sel'khozkhimiya in Altay Kray, the Vesnyegonskiy Association in Kalinin Oblast and Kutuzovskiy in Moldavian SSR.

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## BIOLOGICAL METHOD OF PLANT PROTECTION

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84  
pp 5-6

[Text] The decisions of the 26th Party Congress called for lowering loss of harvest due to pests, diseases and weeds, as well as broader use of biological agents. Integrated protection of plants and, first of all, the biological method that yields not only a high technical and economic effect, but social one, and solves problems of environmental protection play an enormous part in reaching these goals.

This is why there is annual increase in use of the biological method. For example, while it was used on 22 million ha in 1979, the figure was 31.5 million ha in 1983. In this time, there has also been an increase in areas protected by the biomethod in closed ground from 3.6 to 72 million square meters. There are more and more biofactories and biolaboratories, the number of which has doubled, and they are furnished with modern equipment, which permits organization of entomophage production on an industrial footing.

The most widely used entomophage is the Trichogramma. Increasing use is being made of Chrysopidae [lacewing flies], Aphelinus, Habrobracon, Pseudaphycus, Coccophagus, predatory midge, Phytoseiulus, phytophage of Phytomyza leafminers and others. Dendrobacillin, bitoxibacillin, entobacterin, BIP, bactorodencid, boverin, trichodermin and others are the most used biologicals.

Measures aimed at preserving naturally occurring entomophages play a substantial role; they make it possible to cancel chemical treatment of crops and plantations (in 1983, chemicals were not used on almost 10 million ha).

Experience has shown that the biomethod is being introduced extensively in republics, krays and oblasts where proper attention is given to this matter by Party, soviet and agricultural agencies. Let us take, for example, Uzbekistan. In recent years, there has been a more than 6-fold increase in use of the biological method there, while the volume of chemical treatment of cotton plants was reduced by 1 million ha (20%). At the present time, the share of the biomethod in protection of cotton against pests is almost 40%. Expenses to protect the harvest have dropped by 26%. In the near future, the share of the biomethod in protection of cotton against pests will constitute 60-70%!

It was estimated that integrated protection of this cultivar in the republic, with extensive use of the biomethod, will save an average of 4-5 q/ha raw cotton and there will be a 6-10-fold return on each ruble spent.

Recently, a large team of scientists and industrial workers of Uzbekistan were awarded the USSR Council of Ministers Prize for development and introduction of the biological method of plant protection.

We can also cite Tajikistan as an example.. There, integrated protection of the cotton plant, with use of economic thresholds of deleteriousness, colonization of entomophages, regulated use of pesticides, increased role of agro-technical and organizational-economic measures, as well as use of microbiological products, is practiced at the present time at all of the farms. As a result the frequency of chemical treatments has decreased to 1/4-1/5th. Research conducted by the Tajik Scientific Research Institute of Agriculture over a period of 15 years defined the basic routes for using biologicals: the first is activation of natural parasites and predators (minimalization of soil treatment; use of criteria of population size; on site, peripheral and strip treatment; use of agents with selective action; designation of fields to be used to raise alfalfa seed, which attracts many entomophages, etc.); the second involves seasonal colonization of *Trichogramma* and *Habrobracon*, and the third, the use of microbiological agents--*dendrobacillin*, *toxibacillin*.

As shown by the experience gained in Tajikistan and Uzbekistan, even the biological method requires integration. No single agent or preparation yields high results, rather a combination thereof is needed. Mutually complimentary release of *Trichogramma* and *Habrobracon*, combined with microbiological agents (with minimal use of insecticides and acaricides, with consideration of thresholds of deleteriousness) make it possible to implement long-term control of pest development on a level that does not have an adverse effect on harvests.

The systems used with the biomethod make it possible, for example in Tajikistan, to recovery 2.8-7.1 q/ha more raw cotton, 30-100 q more tomatoes and 13-16 q more corn grain than with 2-3-fold pesticide treatment.

In Azerbaijan, all farms have also switched to integrated protection of the cotton plant, with extensive use of biologicals. This has lowered the frequency of chemical treatment against moths and mites to 1/2-1/3d. Use of the biomethod increased by 5-6 times in recent years. Much attention is given to chemicals with selective action.

We have dwelled in detail on protection of the cotton plant, since expressly with this cultivar vast opportunities were manifested for using combined biological agents. It should be stressed that biologicals are used the most in the Ukraine, RSFSR and Uzbekistan. And this is not by chance. A good material and technical base has been established there, mechanized lines are in operation for breeding useful insects; production of microbiological agents has been set up, and there is concern for training qualified personnel.

We shall not discuss the basic scientific developments and accomplishments of individual teams, including those in the head institutions--VIZR [All-Union

Institute of Plant Protection] and VNIIBMZR [All-Union Scientific Research Institute of Biological Method of Plant Protection]. These matters have been discussed repeatedly in this journal. They will also be discussed in the published set of articles. We shall merely dwell on the reserves, problems and unanswered questions, the things that hinder further development of the biological method.

To date, production workers do not have distinct, scientifically validated recommendations concerning criteria of number of harmful and useful species, with which one can do without chemical treatments. There are some generalizations, but they must be systematized and verified. This is one of the main tasks for VIZR, VNIIBMZR and institutes of the republics.

At the present time, there are almost 1400 biological plants and biological laboratories in operation, but there is inadequate control of their performance. There is an acute problem of manning them with qualified personnel and equipment. Incidentally, there is also a shortage of such specialists at plant protection stations.

At the present time, Trichogramma is the principal biological agent. It is used over almost 15 million ha annually. Many problems of breeding, storing and using it have already been solved. There are more than 500 special lines operating in the nation. However, there is still no reliable equipment for mechanized release of entomophage. The efficacy of Trichogramma varies considerably in different zones, populations have not been detected everywhere that have adapted to local conditions. As for mechanized breeding of other useful insects, including the lacewing and Habrobracon, work is still not finished and, for many species it has not even begun.

Serious claims are made to production workers concerning the assortment and quality of released microbiological preparations. Thus far, only four out of 10 items are being delivered. Their shelf life is limited, the efficacy of different batches fluctuates considerably and the price of the products is very high. This has been repeatedly discussed, but the problems are being solved extremely slowly.

In the future, the quantity of biological agents must be increased by introducing useful organisms from other parts of the country, as well as from abroad. Probably, it is primarily the VNITIKiZR [All-Union Scientific Research Institute of Technology of Feed Production and Plant Protection] should deal with these matters first of all.

There is virtually no research being done to find biological agents for control of weeds, plant diseases and pests. There is hardly any validity to statements that deployment of such research is being held back because of the lack of specialized laboratories. At the present stage, this could be done using internal resources, by redistributing projects, eliminating duplication and microprojects, speeding up introduction of already completed investigations. Unfortunately, some structural departments, even of the head institutes, are still duplicating the topics for investigation of republic-level scientific institutions of plant protection.

Some thought should also be given to establishment of a network of VNIIBMZR support centers in other regions of our country. This would accelerate testing and introduction of production of new and effective biological agents.

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CSO: 1840/1078

## IMPORTANCE OF BIOLOGICAL METHOD IN INTEGRATED PROTECTION OF PLANTS

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84  
pp 6-9

[Article by V. N. Titayev, department chief in Administration for Plant Protection of Soyuzsel'khozkhimiya (All-Union Agrochemical Services to Agriculture Scientific Production Association): "Important Link in Integrated Systems"]

[Text] It is growing increasingly apparent that plant protection cannot be limited to use of chemicals. The need to be concerned about a clean environment, integrity of agrobiocenoses and reduction of expenditures to control loss of harvests requires that specialists develop other methods also, in particular, the biological one.

This method holds an important place in integrated systems of plant protection, since it does not require much energy, does not contaminate agricultural products and the environment and does not impair ecological balance, as compared to chemical methods.

In our country, the biological method of protecting open and closed-ground crops comprises the following directions: acclimatization, seasonal colonization (release) of entomophages; use of biologicals; use of naturally occurring useful entomofauna (including entomopathogens, which induces diseases of harmful insects); use of pheromones (sexual attractants); inoculation of plants against viral diseases.

Use of biological methods in our country has increased by more than 130 times in 20 years. We should like to stress that, along with elements of the bio-method that have become traditional, a new direction is developing intensively: use of naturally occurring entomophages. This became possible because we have acquired knowhow in the last few years in evaluating the efficacy of natural enemies. Such work is being done particularly actively in the Russian Federation (4.9 million ha), the Ukraine (4.2 million ha), Moldavia and Tajikistan, as well as Belorussia and Armenia.

Use of natural biological agents is the least energy-consuming, but most effective element of the biological method and, as we know, it involves consideration of number of pests, determination of percentage of their morbidity and parasitism, determination of species composition and number of



entomophages, and ultimately determination of areas over which one does not need to perform chemical treatment because of adequate activity of entomophages and entomopathogens.

There is a large set of useful organisms encountered in agrobiocenoses. It is widely described in recent publications of O. L. Rudakov--"Mycophilic Fungi, Their Biology and Practical Implications" (Moscow, Nauka, 1981), V. A. Tryapitsyn, V. A. Shapiro and V. A. Shchepetil'nikova--"Parasites and Predators of Agricultural Crop Pests" (Leningrad, Kolos, 1982), E. G. Shcheglova--"Insects Against Insects" (Moscow, Kolos, 1982), E. G. Goncharenko and T. I. Bichina--"Predators and Parasites of Orchard Pests" (Kishinev, Kartya Moldovenyaske, 1983).

For example, regular observation is being pursued of such entomophages of vegetable pests as *Chorogenes*, *Apanteles*, *Pteromalus*, *Ernestia*, *Exetastes*, *Aleochara*, *Tribliographa*, various species of *Coccinellidae*, *Syrphidae*, *Chrysopidae*, etc.

In our country, development and refinement of production bioplants and biolaboratories, the number of which has risen to 1360, was instrumental in the broad use of the biological method of protecting plants. More than 5000 specialists work at these facilities.

Biolaboratories and bioplants are being furnished with new equipment, which includes specialized lines for breeding with automatic modes, conditioners, thermostats, autoclaves, humidifiers, polythermostats, which makes it possible to transfer entomophage production to an industrial basis.

In 1983, Union republics received 42 mechanized lines from the Agropribor [Agro-Instrumental] Scientific Production Association, and in 1984 there are plans to deliver 42 more analogous lines and 110 lines produced by Mikond; by 1985, it is planned to bring their total number up to 680.

In 1983, biological laboratories and plants produced entomophages in a quantity sufficient to treat 15.6 million ha (including 14.2 million ha for *Trichogramma*, 0.2 million ha for *Phytomyza* leafminer and over 1 million ha for *Habrobracon*), and biologicals to cover 3.3 million ha were manufactured.

Science has proposed new developments and recommendations, which will make it possible, in the near future, to produce even more effective agents at the biolaboratories and bioplants.

However, experience with the biological method shows that, both now and in the future, *Trichogramma* will be the principal item, as before. It is planned to augment the areas for its use in the very near future, mainly by expanding utilization in Central Asia and several parts of RSFSR.

In recent years, new scientific data have been obtained and production knowhow has been accumulated, which permit solving problems of breeding, storing and using *Trichogramma* on a higher level. Apparatus for long-term storage of *Trichogramma* is being developed and tested under industrial conditions, and this will permit year-round breeding at biolaboratories and bioplants. Various

designs of ground-based and airborne equipment for mechanized release of the oviparasite are being tested.

Use of biological agents is increasing annually also when raising farm crops in protected ground. Here, broad use is being made of the predatory mite, *Phytoseiulus*, and the biological product, bactorodencid; it is planned to increase use of the green lacewing, predatory gall midges and other aphidophages for control of aphids; methods of breeding and use are being developed with regard to the *Encarsia* parasite and fungus pathogens--*Aschersonia* and *Verticillium* against the glasshouse whitefly, trichodermin, which is effective in the control of root rot; a method of inoculating tomatoes against tobacco mosaic virus is undergoing production trial.

In 1983, the biological method was used to treat 72 million square meters, including use of *Phytoseiulus* on 33.4 million m<sup>2</sup>, *Encarsia* on 287,000 m<sup>2</sup>; green lacewing on 16,000, predatory gall midge on 260,000, trichodermin on 19 million, verticillin on 77,000, *Aschersonia* on 243,000, boverin on 701,000 m<sup>2</sup>, etc. Much work is being done in particular to introduce the biomethod in protected ground in the RSFSR.

The main biologicals used are dendrobacillin, bitoxibacillin and entobacterin, which are furnished by the microbiological industry, as well as bactorodencid, boverin and trichodermin, which are produced in veterinary and biological laboratories. Unfortunately, the industry in the system of Glavmikrobioprom [Main Administration of the Microbiological Industry] has delivered to agriculture only 4 different microbiological agents based on *Bacillus thuringiensis* for treatment of 2.6 million ha.

There has been the most graphic development of the biomethod in our country in Uzbek SSR, where in the last years alone use of biologicals increased by 6.3 times, including more than 21-fold increase in use of entomophages and 2.3-fold increase in use of biologicals. In 1983, for example, *Trichogramma* was used on 2,389,000 ha, *Habrobracon* on 1,029,000 ha, *Phytomyza* on 13,800 ha; microbiological agents produced industrially, in particular, dendrobacillin, were used to treat 921,000 ha and BTB was used on 300,000 ha.

From 1976 to 1982, the use of chemicals for cotton plant treatment was decreased, as a result of reducing frequency of pesticide use and increasing the share of the biological method, from 66.5 to 38%, while expenses for control decreased from 24.6 to 18.9 rubles/ha. With use of the biomethod to control the bollworm and turnip moth on cotton fields, 2.5 q/ha harvest was preserved and the additional income constituted 79.6 rubles/ha.

N. M. Yerem'yants, recipient of the USSR Council of Ministers Prize, chief of the Namangan Oblast Plant Protection Station, believes that, with prompt and proper use of *Trichogramma* and restoration of naturally-occurring useful entomofauna in cotton plant agrocenoses, the quantity of moths, aphids and mites drops so drastically that there is no longer a need to use chemical treatment against them.

The biological protection method is also used extensively in the RSFSR, Ukraine, Kirghizia and Turkmenia--over 20, 25, 32 and 35%, respectively, of the total

treated area. Yet the share of the biological method of control in the overall volume of protective measures does not exceed 10% in Moldavia, Kazakhstan, Tajikistan and Transcaucasian republics, and it is only 1% in Armenian SSR.

Use of sex attractants--pheromones--is a new direction in plant protection. In order to keep track of the number of pests and set dates for control of the codling moth, European grape moth and click beetle, use of pheromone traps was begun in 1981; this work was done on 85,000 ha and, already in 1983, 695,000 traps were placed over an area of about 2 million ha. There has also been expansion of the range of targets for registration of which pheromones are used; they include the bollweevil and other types of moths, tortrix moth, cornborer and beet webworm. Procedures are also being developed for using pheromones in direct control of pests--methods of male vacuum and disorientation.

Further increase in area of application of the biomethod is being delayed by a number of factors. Agriculture is still being furnished with an extremely limited assortment of biologicals. The methods, technology and equipment for mass-scale breeding and application on fields of biological agents are slow in being developed and refined at scientific research institutes for plant protection. The search for biological agents to control weeds, diseases of plants and stock pests is not being pursued actively enough. Methods have still not been developed for use and preservation of naturally occurring useful organisms, although in practice such work is already being done over an area of 10 million ha.

There is poor local control of the work of biolaboratories and bioplants, and of the biologicals they produce. These departments are not adequately supplied with equipment and transportation. There is also a shortage of personnel. True, starting this year, specialization has been added and the course on the biomethod has been expanded at agricultural VUZ's of our country, in departments and faculties of plant protection, whereas a separate study group was formed at the Tashkent Institute of Agriculture and 1-2-month specialization courses have been organized at the Leningrad Institute of Agriculture and Ukrainian Agricultural Academy. However, the need for personnel as a whole is being poorly met thus far. There should be an average of about 250 specialists trained annually, including 200 with higher education.

It is imperative to expand research and expedite completion of started work dealing with augmentation of the assortment of biologicals, mechanization of their production and use; efforts should be directed toward predominant use of the method in cotton-raising and resort zones, in regions of drainage basins and fisheries, etc. It is time to provide a material incentive for farms to raise crops without using pesticides.

The solution of these problems will serve the cause of development and expansion of use of the biological method, reliable protection of harvest, prevention of contamination of agricultural products and the biosphere with pesticides.

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CSO: 1840/1078

PERFORMANCE OF ALL-UNION SCIENTIFIC RESEARCH INSTITUTE OF BIOLOGICAL  
METHODS OF PLANT PROTECTION IN KISHINEV

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84  
pp 6-9

[Article by N. A. Filippov, director of VNIIBMZR,: "At the Head Institute"]

[Text] The All-Union Scientific Research Institute of Biological Methods of Plant Protection (VNIIBMZR) was founded in 1969 (277060, Kishinev, 58 Mir Prospekt; telephones: 53-03-40 for reception office, 53-06-83 for the director, 53-03-61 for scientific deputy director and 53-07-18 for scientific secretary). Its tasks include development of theoretical bases and practical procedures for using biological agents to protect plants and investigation of technology and economics of their use in integrated systems; investigation of species composition, ecology and means of preservation, accumulation and activation in agrobiocenoses of entomophages of the principal pests; search, identification and selection of microorganisms of promise for control of pests and diseases of plants; identification and synthesis of sex attractants (pheromones) for harmful insects.

This institute coordinates research on problems of the biological method of plant protection in the nation, it implements methodological supervision of production biolaboratories, it organizes dissemination of information about scientific advances and progressive knowhow in the area of biological protection, it elaborates recommendations for introduction of production of biologicals.

There are 340 people employed at the VNIIBMZR, including 150 scientific associates and engineers, 80 of whom have scientific degrees.

The institute has 20 laboratories and departments dealing with the following:

Infectious pathology of deleterious organisms (chief--V. V. Guliy, doctor of biological sciences)

Technology for using microbiological agents (V. Ye. Likhovidov, candidate of biological sciences)

New Biologicals (T. V. Teplyakova, candidate of biological sciences)

Biological control of plant diseases (A. I. Bondarenko, candidate of biological sciences)

Chemistry of attractants (B. G. Kovalev, candidate of chemical sciences)

Technology for using pheromones and other biologically active substances (V. I. Voynyak, candidate of biological sciences)

Chemical analysis laboratory (G. F. Vylegzhanina, candidate of agricultural sciences)

Problem laboratory for Trichogramma (Sh. M. Grinberg, candidate of agricultural sciences)

Biochemistry and physiology of insects (I. G. Yazlovetskiy, candidate of chemical sciences); mass-scale insect breeding (P. L. Talpalatskiy, candidate of biological sciences)

Mechanization of the biomethod (A. S. Abashkin, candidate of engineering sciences)

Systematics, ecology and introduction of entomophages (V. A. Matsyuk, candidate of biological sciences)

Ecology and forecasting agricultural pests (V. A. Minyaylo, candidate of biological sciences)

Biological protection of plants in closed ground (N. A. Popov, candidate of biological sciences)

Biological protection of vegetable crops in open ground (N. A. Filippov, candidate of agricultural sciences)

Economics of the biomethod (V. A. Cherkasov, candidate of economic sciences)

Coordination and Scientific-technical information (V. A. Shapa, candidate of biological sciences); introduction and support network (A. P. Rotarenko, candidate of agricultural sciences)

Standardization and metrology (B. A. Voroshilov, candidate of engineering sciences)

Biophysics and agricultural radiology (Yu. I. Nekrasov, candidate of biological sciences).

The institute's specialists have made comprehensive studies of entomophages of fruit and vegetable pests in Moldavia; they have determined the role of naturally occurring populations of the most important parasites and predators, defined some of the routes of accumulation, preservation and increase in their biological activity in agrobiocenoses. Original faunistic studies have been

made of the parasites of cereal crop and other aphids, orchard moths, tortrix and other moths, San Jose scale, fall webworm moth, cereal crop flies and other pests.

The VNIIBMZR devotes much attention to questions of biological control of vegetable crops and flowers in protected ground. A method has been refined for mass-scale breeding of *Phytoseiulus*; standards, time and methods of using it have been defined for different types of hothouses in the southern part of our country.

For the control of the glasshouse whitefly in southern hothouses, the VNIIBMZR has recommended the technology of mass-scale breeding and use on various vegetable crops and flowers of a specialized *Encarsia* parasite, which suppresses virtually entirely the development of pests when released 2-3 times.

The institute is developing the technology for mass-scale breeding and hothouse use of the green lacewing and other useful predatory insects for biological control of aphids on vegetable crops. Methods are being refined for mass breeding of several entomophages on synthetic nutrient media.

Studies are in progress of the species composition and genetic systems of the *Trichogramma*, its biology and ecology, various means of enhancing the efficacy of this oviparasite. In particular, more sophisticated systems for breeding it in industrial biolaboratories have been recommended; a rational technology for its use has been validated; equipment has been proposed for storing the entomophage in diapause for 6-7 months, which increases bioplant output by 1.5-2 times and eliminates their seasonal operation.

Together with other scientific and planning-designing organizations, the institute has worked out and is submitting to industrial testing equipment for ground-based and airborne release of *Trichogramma* on fields.

The technology for using several other promising entomophages is also being upgraded. Positive results have been obtained under production conditions at Moldavian farms from seasonal colonization of laboratory-bred predatory bugs--*Podisus* and *Perillus*--to control the Colorado beetle on early potatoes and eggplant, as well as the predatory gall midge, *Aphidimyza*, against the cabbage aphid.

A search is being pursued in different soil and climate zones of the USSR for microorganisms for potential use to control farm pests. The institute has a collection of cultures of viruses, bacteria, microscopic fungi and parasitic protozoans, on the basis of which biologicals could be produced.

Specialists have proposed a method for producing virin-OS to control the cabbage moth. A method has been developed for testing the quality of viral insecticides with an electron microscope; optimum conditions for storing them have been studied and recommended.

Lekani, which is based on the entomopathogenic fungus--*Verticillium*--has been proposed for control of the glasshouse whitefly, and in 1983 its introduction in hothouses was organized over an area of more than 100 ha.

Extensive studies are also being conducted on biological control of a number of pathogens of plant diseases in closed and open ground.

Recommendations have been prepared on use of trichodermin against the pathogens of root rot in seedlings of vegetable, tobacco and other crops. Together with the Moldavian Station for Plant Protection, the institute organized production of trichodermin at a number of production biolaboratories.

There were recommendations given on use of the antibiotic, trichothecin, for control of powdery mildew of cucumbers in hothouses of the southern zone. Tests are in progress for use of strains of the fungus, *Ampelomyces*, in control of powdery mildew in vegetables. Studies are also in progress of feasibility of biological suppression of white and gray rot of sunflowers using the hyperparasite fungus, *Coniotirium*, antagonist of *gliocladium* and others.

A search is being made for effective strains of predatory fungi for control of the root-knot eelworm in protected ground.

Together with other scientific research institutes, the VNIIBMZR developed and is introducing the technology for using pheromones of the codling, plum fruit and oriental moths, gipsy and black arches moths, boll weevil, cabbage and other moths, European grape moth and other tortrix moths, click beetles and potato moth to monitor the number of pests and learn when control measures should be used. Preparative forms of pheromones of a number of extremely important pests have been selected; optimum types of domestically produced traps have been developed, as well as types of adhesive; studies are being pursued of methods for analysis of pheromones and their dynamics in the environment.

A study is being made of possible use in plant protection of regulators of growth, development and reproduction of harmful insects (hormones, inhibitors of chitin synthesis). Thus, according to the data of the VNIIBMZR, use of juvenoid 80-A is promising for control of the glasshouse whitefly, and so is dimilin, which arrests ecdysis and development of larvae of the Colorado beetle.

Long-term laboratory cultivation of moths--bollworm, cabbage, turnip, small mottled willow, s-black, tomato, *Polia dissimilis*, heart-and-dart, dark sword-grass, etc.--as well as the fall webworm moth and other harmful insects. Together with the Agropribor [agricultural instruments] Scientific Production Association, lines are being developed for mass-scale breeding of the cabbage moth and bollworm in order to recover eggs used in the process of *Trichogramma* passage, as well as for caterpillar production.

The VNIIBMZR devotes considerable attention to dissemination of scientific technical information and propaganda in the area of biological plant protection: collections of scientific works and monographs, methodological instructions, recommendations, etc., are being published. Its staff participates in All-Union and republic-level seminars and courses, scientific-production conferences, symposiums and meetings in different parts of our country and abroad. The institute is a participant in special-topic exhibitions, both



in our country and abroad. In 1980-1983, the VNIIBMZR held three international symposiums on integrated and biological plant protection.

The institute is a permanent member of the east palearctic section of MOBB [International Organization for Biological Control of Harmful Animals and Plants]; it participates each year in the work of the Coordination Center and Council of Delegates of CEMA member nations dealing with the problem of "Plant Protection." The VNIIBMZR collaborates on many problems and exchanges information with scientists of the United States, France, Netherlands, Finland, FRG, Czechoslovakia, GDR, Hungary, Bulgaria, Romania, Poland and other countries.

There is an experimental production farm at the VNIIBMZR (director A. V. Kekyu, chief agronomist G. S. Kharti), which is located in Bachoy in Kutuzovskiy Rayon. At this experimental production farm, the institute tests and introduces abbreviated systems for chemical protection of orchards and vineyards, microbiological preparations, pheromones, procedures for preserving and activating naturally occurring populations of entomophages in orchards.

In the near future, construction of a new complex at the VNIIBMZR will be completed, which will include chemical and biological units. This will raise the scientific and methodological standards and yield from research, and it will produce stock cultures for agricultural production.

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CSO: 1840/1078



## BACTERIAL METHOD OF CONTROLLING RODENTS

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84  
pp 15-17

[Article by V. A. Bykovskiy, senior scientific associate at VIZR (All-Union Institute of Plant Protection), N. V. Kandybin, laboratory head at VNIISKhM (All-Union Scientific Research Institute of Agricultural Microbiology), L. K. Serebryakova, senior scientific associate, T. G. Omel'yanets, senior scientific associate at VNIIGINTOKS (All-Union Scientific Research Institute of Hygiene and Toxicology of Pesticides, Polymers and Plastics) and N. P. Yushchenko, senior agronomist of the Plant Protection Administration of Soyuzsel'khozkhimiya (All-Union Scientific Production Association for Agrochemical Services to Agriculture)]

[Text] Almost 100 years ago, Louis Pasteur proposed the use of the fowl cholera bacterium, which he had discovered previously, to control rabbits in Australia. I. I. Mechnikov advised their use, on the basis of his experience, to exterminate susliks [ground squirrels] in southern Russia. These recommendations were the start of the bacterial method of rodent control. N. F. Gamaleya, S. S. Merezhkovskiy, B. L. Isachenko, K. N. Rossikova, M. P. Golubeva, M. I. Prokhorova and others were instrumental in development and refinement of this method. Comparatively many microorganisms that are pathogenic to rodents were proposed; however, at the present time, Isachenko bacterium and strain 5170 are virtually the only ones in practical use in our country. Such a "reduction of assortment" was undertaken chiefly in the interests of disease prevention among humans and domestic animals.

Isachenko and strain 5170 bacteria are referable to the Enterobacteriaceae family, genus Salmonella, group D and of the Salmonella enteritidis type (according to diagnostic systems of Kaufman and Kaufman-White). They were singled out from the former biochemical variant (Danich) as an independent one (Isachenko variant) on the basis of research that demonstrated a substantial difference between Isachenko and Danich bacteria according to the lysozyme reaction (N. V. Kandybin, 1974). They also differ in pathogenicity: Danich bacteria are less specific, and for this reason there is the fear that they could induce an infectious disease in man and some domestic animals; Isachenko bacteria are not pathogenic for them (T. G. Omel'yanets, 1978). There are also several other known differences.

The house and mound mice, which also contract salmonellosis from other *Salmonella* species, are the most susceptible to Isachenko bacteria (including strain 5170). The striped and yellow-necked field mouse, Ciscaucasian and Asia Minor hamsters, and forest dormouse are naturally resistant to Isachenko bacteria. Susliks, gerbils, jerboas and field mice are relatively resistant; the brown, black and Turkestan rats are more susceptible, while several species and genera of voles, the Chinese striped hamster and harvest mouse are even more susceptible.

The composition of naturally susceptible species is virtually stable, and it is determined by genetic factors, whereas the possibility of expression of an infectious process as an epizootic is variable and depends on many conditions. They include the microorganism's ability to survive in the environment before penetrating into the macroorganism, to overcome its defenses and reactions, multiply in it, induce septicemia, poisoning and metabolic disturbances.

The dissimilar species-specific, age-specific and population-specific susceptibility of rodents, as well as several other factors, increase the difficulty of using bacteria against them. Still, the specifics of these correlations have been disclosed to such an extent at the present time, that it is possible to improve the technology of production and use of bacterial preparations. Problems of recovering and storing virulent strains have been developed the most fully. Veterinary laboratories, as well as the biolaboratories of plant protection stations can request them from the All-Union Scientific Research Institute of Agricultural Microbiology. Much attention was devoted to find forms of preparation that would permit accumulation of bacteria without worsening of properties, as well as easier use.

According to theoretical conceptions and economic indications, it is wise to use granulated forms based on such media as grain or bone filings (M. I. Prokhorov, 1962). Recently, the technology of producing such preparations, which were given the common name of bacterodencid, was significantly changed (N. V. Kandybin et al., 1979), and this was due to the need to radically improve the quality of the plant product. There was elimination of operations that worsened the state of bacteria and were instrumental in contaminating the product. Several technological innovations were used in order to preclude presence of extraneous microflora and virulent form of bacteriophage in bacterodencid. The produced granules are packaged in polyethylene bags, which are sealed and then submitted to gamma sterilization. For treatment of a crop with the granules, it is injected directly in the bag with a thick needle. The sealed packaging makes it possible to reactivate the product within 1 day at 36-38° after long-term storage in a refrigerator, or even at room temperature without fear of contaminating it with other microorganisms.

The described technology is used to obtain moist forms with higher (than before) water content, which retain their properties from 6 to 12 months (depending on temperature in storage rooms).

It is allowed to use the granular and amino-bone moist products for experimental production purposes instead of the previously furnished dry forms. Production of both forms of moist bacterodencid has been fully assimilated at the Experimental Production Enterprise (EPP) of VNIISKhM, and the grain product is also prepared locally.

When producing the biological agent, it is extremely important not to disrupt the technological conditions. The properly manufactured grain product remains as loose mass of softened grain with 52-56% moisture, without acid or putrid odor, for the duration of the guaranteed shelf life. There must be at least 1 billion bacteria per gram product; presence of extraneous microflora is inadmissible. If sterilization and sealing specifications for the packaging are not met or are impaired during transportation or storage, the product must be used immediately, provided it has the standard appearance, otherwise it must be discarded.

Bactorodencid should be used with due consideration of ecological distinctions of rodents, Isachenko bacteria and sanitary-hygienic rules. These conditions are included in the concept of technological discipline and proper implementation of measures to protect plants. It is extremely important for the product to be readily found and well-consumed by the rodents, against which it is used, and for the bacteria contained in them not to lose their virulence prematurely. The grain base of the product should be viewed not only as the habitat of bacteria, but as bait for rodents.

Wheat, oat, rye, barley or other cultivar grain is not equally tempting to different species. Most rodents consume barley relatively poorly, and it should not be used as bait. For small rodents, it is best to use wheat or oat grain, and for the water rat, peas. The natural diet of the brown rat includes feed not only of plant origin, but animal origin, and inclusion in the bait of fat or protein increases its attraction considerably. Moisture content of the bait is also important. Unlike house and mound mice adapted to a dry climate, common voles which are the typical inhabitants of steppes with grain crops and diverse herbaceous plantations require succulent and moist feed. Since the deleteriousness of common voles has increased in recent times, one should give a positive rating to the change from production of dry to moist bactorodencid. The amino-bone preparation, which contains protein, is more consistent with the specifics of brown rat diet than the granular one. The water rat prefers soaked peas to cereal grain, but vegetable root crops are particularly attractive to it, so that it is best to prepare the bait by applying the amino-bone preparation on raw potatoes, etc. The existence of two forms of bactorodencid makes it possible to vary their use, with consideration of species-specific diet and water metabolism of rodents.

From the economic point of view, granular bactorodencid has one advantage over amino-bone: this form is ready for use. Before use, the amino-bone product must be mixed with bait in a 1:4 ratio.

The method of using bactorodencid affects the efficacy of control. It is known that when the product is stacked or placed in many layers in the field, there is better preservation of bacteria than with scattered, monolayer use. Placement of bactorodencid in burrows or other shelters has the same advantage, as compared to open scattering.

Isachenko bacteria contained in the product are particularly sensitive to solar radiation at high daytime temperatures, which are inherent in the southern part of our country. Under such conditions, bactorodencid in open areas loses 50% of the bacteria per day, and 44% die off in the morning. A side-effect is

also observed, which causes appearance of active bacteriophage that is devastating to virulent bacteria and stimulates their change to an avirulent form (N. V. Kandybin et al., 1978). Bait that has dried up in the course of a day loses its appeal for moisture-loving rodents. Precipitations also have an adverse effect on it. Of course, such control does not lead to good results.

When the granular bactorodencid is laid out in the field in shelters in the evenings, efficacy of extermination measures against small mouse-like rodents is improved. The amino-bone preparation is less suitable for this purpose, since it provides poorer protection of bacteria against rigorous meteorological conditions.

As a rule, bactorodencid elicits disease only in specimens that ingest bait that contains it. It is not always possible for an epizootic to develop by re-infection (i.e., as a result of contact between healthy and sick animals), since it depends on the condition of the parasite and host, their correlations and the specific ecological situation. When there is a high density of rodents there is an increase in frequency of their contacts and sometimes stimulation of aggressive behavior and cannibalism, thereby increasing the probability of an epizootic. It has been possible to induce an epizootic under experimental conditions among common voles with a population density of 300 to 555 specimens/100 m<sup>2</sup> after part of it (31-50%) had been artificially infected with a lethal dose of Isachenko bacteria. With a stack of straw in the pen, death of intact animals was observed in 2 out of 5 experiments, and mortality constituted 52-78%. When there was clover mixed with oats planted in the pen, instead of the stack, deaths were recorded in 6 out of 7 experiments and mortality rate was 48-100%. Thus, the agroecological conditions affected the epizootic process appreciably. Experiments on different species of small mouse-like rodents, which were performed in areas of their natural concentration (wheat straw stack, section of linden forest), revealed that introduction of infection in a large population of these mammals caused a brief and mild epizootic, which regressed as the number of animals declined. No negative effect on the process of rodent reproduction was observed (N. V. Kandybin, 1974). However, after pregnant female rats were fed bactorodencid, there were fewer offspring per litter and their development was retarded (V. A. Bykovskiy, S. G. Pegel'man, 1981).

The foregoing indicates that the most suitable conditions for use of bactorodencid in the field are present in areas of aggregation of small myomorphs (in stacks, ricks, forest strips, grain storage buildings, etc.). In addition, granular bactorodencid should be used in the fall-winter and early spring on open agricultural plantations near populated areas, livestock and poultry farms, areas of seasonal concentration of game and other areas where chemical treatment is restricted or disallowed. The amino-bone product is intended mainly for control of synanthropic rodents, as well as water rats.

In the case of poor technical efficacy of using the biological agent, without eliminating the hazard of appreciable harm to farm crops (for example, there is information to the effect that it diminishes in the control of the common vole during the period of drastic increase in number of these rodents), one should use the chemical, mechanical and agrotechnical control methods, instead of bactorodencid. A change in method is necessary because of the possibility of development of immunity to Isachenko bacteria in rodents in a treated

region. However, this immunity does not last long, and it is allowed to repeat bactorodencid treatments against small myomorphs after 2 months.

When the product is used regularly, stable increase in resistance to it is possible among susceptible rodents. It has been determined that lysozyme, an enzyme that has a strictly selective effect on Isachenko bacteria, is present in visceral tissues of many of these species. Under its effect, the bacteriophage changes to an active state and destroys virulent cells or stimulates their transformation to an avirulent form. Although the phage titer and its activity are species-specific and it is encountered relatively seldom in susceptible animals, there is a possibility of population selection for resistance to the product. This also makes it necessary to promptly change control methods.

Sanitary and hygienic studies have shown that Isachenko bacteria and strain 5170 are relatively safe to man. Undesirable consequences may occur when there are gross infractions of rules for producing or using the product. When working with bactorodencid, it is imperative to prevent the product and bacteria from penetrating into the human body and foods (it is difficult to make prompt detection of mass scale contamination with such salmonella of meat and dairy products).

Domestic animals have been repeatedly tested in the laboratory for resistance to Isachenko and strain 5170 bacteria. After ingestion by mouth of large doses of bacterial culture, no clinical signs of disease were demonstrated in horses, sheep, swine (adult and young specimens), dogs, cats, adult rabbits, geese, ducks or chicken. Signs of enteritis and brief temperature elevation were found in calves (M. I. Prokhorov, 1961; D. F. Trakhanov, 1973) and lambs (D. F. Trakhanov, 1973). Cases of death were observed in experiments with young rabbits (M. I. Prokhorov, 1962) and lambs (D. F. Trakhanov, 1973); the possibility cannot be ruled out that Isachenko bacteria merely complicated another pathological process present in these animals. However, it was deemed beneficial to forbid the use of bactorodencid in large livestock breeding complexes.

The question of effect of this product on wild animals has been studied less. It was established that the muskrat (I. N. Gritsenko, 1971) and sparrows (M. I. Prokhorov, L. Ya. Sintsova, 1953, 1959; M. I. Prokhorov, A. Ye. Khrutskiy, 1961) are susceptible to Isachenko bacteria. The information about pathogenicity of Isachenko bacteria for polecats was not confirmed; it was established that they are resistant to oral and subcutaneous administration of these bacteria in a large dosage (I. N. Gritsenko, 1971). The extent of susceptibility of hares, particularly young specimens, and widespread granivorous birds, such as bunting, common partridges, etc., has not yet been determined.

There has been virtually no assessment of the actual effect of bactorodencid on the aggregate of warm-blooded animals that inhabit or visit land treated with this agent. There have been virtually no studies of circulation of Isachenko bacteria in agrobiocenoses. It is merely known that strains differing in virulence have been detected in undigested food pellets of predatory birds, and the share of highly virulent ones constituted 37.5%, whereas in the body of these birds the bacteria partially lost their toxigenicity (N. V. Kandybin et al., 1978).

It would be desirable to eliminate the above-mentioned shortcomings in the next few years. A second, equally important, task is to develop procedures that would improve the degree and stability of bacterodencid action on myomorphs, particularly in the field. A search must also be made for new microorganisms that would hold promise for use in control of rodents.

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CSO: 1840/1078

## QUARANTINABLE DISEASES OF PLANTS

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84  
p 33

[Article by L. V. Voronkova, M. A. Primakovskaya, department chiefs at VNITIKiZR (All-Union Scientific Research Institute of Feed Production Technology and Plant Protection), and Ye. I. Voronenko, chief specialist of the State Inspectorate for Plant Quarantine under the USSR Ministry of Agriculture, "Attention to Quarantinable Diseases"]

[Text] Such diseases as Indian smut, yellow mucous bacteriosis of wheat, bacterial wilt of corn and cotton plant spot do not exist in the Soviet Union. The repeated detection of pathogens of these diseases in expert examination of breeding specimens coming from abroad shows that their penetration into our country is possible.

Indian smut (pathogen *Neovossia (Tilletia) indica*) is widespread in Afghanistan, Burma, India, Iraq, Pakistan, Turkey, Mexico and the United States. It could appear in the USSR in Central Asia, North Caucasus, Georgia and Crimea, particularly on irrigated wheat. Sick seeds are the source of infection.

This disease differs somewhat from other smut diseases with regard to symptoms. Indian smut strikes the embryonic part of the grain and furrow, while covered smut, for example, strikes all grain tissue, with the exception of the outer shell.

In the field, Indian smut can be detected only when crops mature, when diseased grain is visible when the spikelets open. The distinction of this pathogen is that it can form clumps of chlamidospores. But it is easier to find Indian smut chlamidospores in wheat seeds after harvesting (by the method of centrifuging aqueous washings from the seeds).

Yellow mucous bacteriosis of wheat (pathogen *Corynebacterium tritici*) is detrimental in India, Iraq, Korean People's Republic, Arab Republic of Egypt, Ethiopia, Australia and Cyprus. In our country, the climate conditions are favorable for its development in Central Asia, Transcaucasia, Moldavia and southern Ukraine. Stricken seeds and wheat nematode gall are the main sources of spread of the disease.



Disease symptoms appear on leaves in the form of lengthwise, narrow white and yellowish bands. Then the spikes become distorted and deformed, and bright yellow bacterial mucus (typical sign) is secreted on them, which forms a viscous layer between the sheath and spike, and between spikelet lemmas. In dry weather, the mucus dries, hardens and changes into a delicate yellow film; at high humidity of the air, so much mucus is secreted that it can drip. Diseases plants are retarded in growth. It is best to inspect plantations during the wheat tillering period, when signs of the disease are the most distinct.

Bacterial wilt of corn (pathogen *Erwinia stewartii*) has been recorded in the United States, Canada, Mexico, South Africa and Italy. It could be brought into the Soviet Union with seeds infected not only on the surface, but internally. The disease starts with appearance of lengthwise striated spots on the bottom leaves. At first the light green spots turn yellow, spreading rapidly over the veins and forming bands along the leaf that move on to the stalks. There is often an exudate in the form of small droplets containing bacterial mass (most typical symptom) on the spots and cross-sections through the leaves and stalks.

The bacteria, which spread over the entire plant, cause premature appearance of white panicles. The seeds become undersized and shriveled. When there is severe infection, the plants perish at early stages of development or become dwarfs, and they usually do not bear fruit. The symptoms are manifested differently, depending on susceptibility of a cultivar. In early ripening sweet-corn cultivars that are not resistant to wilt, young seedlings are rapidly stricken, wilt and perish. In more resistant varieties of field or feed corn, bacteriosis usually appears later; there are fewer cases of wilting or growth retardation, the bands are less marked on the leaves and they become noticeable after appearance of panicles, bacterial secretions are less noticeable on stalk sections.

Infection spreads with contaminated seeds and plant residue. The best time for inspection is from the start of flowering to the panicle-appearing period, as well as phase of milk and yellow ripeness, 10-15 days before harvesting.

Cotton plant spot (pathogen *Glomerella gossypii*, conidial stage *Colletotrichum gossypii*) is encountered in countries where cotton is raised. If it penetrates into the USSR, the disease may spread in all cotton-growing zones.

The fungus attacks the above-ground part of the plant at different phases of its development. As a rule diseased seedlings are lodged. The pathogen causes reddish spots on the root collar, which involve the stalk, forming a constriction. Dark brown spots with a reddish band are formed on cotyledon leaves. The stalks and leaves are stricken less often. Reddish-brown elongated spots appear on the stalks, and on the leaves they are round and dark. Fungal disks (fruiting) extend in concentric circles on the spots. The bolls are stricken with the disease the most seriously. At first, small, round, indented dark brown or purple spots appear on the boll glumes, which gradually darken (with retention of reddish coloration along the edges). As they increase in size, the spots merge and involve most of the boll. In humid weather, they become covered with the pink mass of fungus spores. When severely stricken, the glumes adhere to one another and dehiscence is difficult, the fibers and



seeds turn grayish brown, adhere to one another and rot. High ambient humidity is favorable for development of the disease. The disease spreads with seeds, within or on which there are mycelium and spores of the fungus. The optimum time for detection of this disease is the period of shoots before appearance of 3-5 true leaves (before thinning) and the period of mass scale formation and dehiscence of the first bolls, when the symptoms are the most vivid.

In order to protect agricultural plantations against quarantinable diseases, seeds arriving from abroad undergo additional inspection and expert quarantine evaluation, and they are checked in the introduction-quarantine nurseries. The breeding plantations of scientific research institutes, experimental stations, state testing plots and fields planted with imported seeds are kept under special supervision.

It is necessary to inspect wheat, corn and cotton plantations at the times that are best for detection of quarantinable diseases. If suspect specimens are found, they must be identified and forwarded to the closest laboratory of the State Inspectorate for Plant Quarantine of the USSR Ministry of Agriculture or sent to the expertise group of VNITIKiZR to confirm the species of the pathogen of the quarantinable disease, to the following address: 107139 Moscow, 1/11 Orlikov Lane, USSR Ministry of Agriculture, Expertise Group of VNITIKiZR.

#### Conference of Quarantine Service Workers

In March, there was a conference of quarantine service workers at the VNITIKiZR. Reports were delivered by the chiefs of republic-level inspectorates concerning work and finances in 1983, as well as the tasks for 1984.

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CSO: 1840/1078

## BEET WEBWORM HAZARD IN USSR

Moscow ZASHCHITA RASTENIY in Russian No 5, May 84  
p 43

[Article by V. V. Poplavskiy, Honored Agronomist of the RSFSR]

[Text] Mass scale development of the beet webworm was noted in regions of East Siberia and the Far East in 1982. Emergency steps were taken there to protect farm crops. In East Siberia, a large number of these pests has also been predicted for 1983. However, because of inclement weather in the involved regions, development of this webworm was delayed, which lowered the danger, and the volume of planned work was reduced to almost one-half.

In the European part of our country, concentrations of caterpillars were encountered in Rostov Oblast, Stavropol and Krasnodar krais, in the Ukraine and Moldavia. There were few second-generation pests and their development extended over a longer time. Caterpillars were encountered on sugar beet plantations and perennial grasses, on weeds along the periphery of the fields. Mainly the biological method was used to control this webworm--Trichogramma was released.

In West Siberia, the warm spring favored mass-scale flight of the webworm moths of the local generation in the first half of June 1983. A migrating population probably participated in the second wave of flight, in late June to early July, from eastern parts of Siberia where there had been a mass-scale flight at that time of generations that had developed over the winter and were 10-15 days late, as compared to the average time observed for many years.

There was a drastic increase in number of webworms in Altay Kray, Novosibirsk, Omsk and Tomsk oblasts. Butterfly fertility was high there (160-260 eggs per female), which resulted in a large number of caterpillars on the crops. For example, up to 96 caterpillars/m<sup>2</sup> were found on corn, up to 400 on sunflowers, 230 on sugar beets, 150 on perennial grasses and up to 3000 caterpillars/m<sup>2</sup> in foci. The harm of the webworm was also manifested on flax, pea, potato, grain and vegetable crops.

A fall survey in West Siberia revealed that the areas populated by this pest are growing (average number of hibernating cocoons was 2.6 to 10.7/m<sup>2</sup>, and 120-240 in sites in Omsk and Novosibirsk oblasts).

According to the 1983 forecast, it was expected that West Siberia and the western part of East Siberia (Krasnoyarsk Kray, Irkutsk Oblast) would be the principal site of reservation and damage by the beet webworm, and this was confirmed by the spring inspections.

A considerable number of hibernating cocoons was found in Tselinograd, North Kazakhstan, Kustanay, Kokchetav, Pavlodar and Karaganda oblasts, although there was minimal flight of butterflies there in 1983.

In view of the decline in number of beet webworms over most of its habitat, attention to them waned on the part of kolkhoz and sovkhoz agronomists, as well as specialists in the plant protection service. In a number of instances, due consideration was not given to the fact that butterfly flight had shifted from crops to perennial grasses, undeveloped regions, flowering vegetation in forest strips, meadows, river floodplains and on the banks of rivers, and the fall inspection was made chiefly of agricultural crops, rather than at the main sites of hibernation of this pest. With this in mind, appropriate corrections were made at most farms in the spring of 1984, and a thorough inspection was made of farmland, particularly in areas where the butterflies or caterpillars had developed last year.

The agronomic personnel of the farms and employees of plant protection stations prepared for prompt control of the beet webworm. Starting in the fall, preventive soil treatment that had been recommended for specific zones was started in autumn at the sites of expected damage; in areas of perennial grasses, road shoulders, forest strips, unused and virgin land, where cocoons had been found, disk harrows were used and this lowered the pest population. Wherever there had not been enough time to take the above-mentioned steps in the fall, they were performed in the spring.

Of the measures performed against the beet webworm in the spring, a significant effect is obtained by treating inter-rows between cultivated crops 2-3 days after mass-scale deposition of eggs.

Eradication of weeds is also very important as a step that deprives butterflies of additional food and lowers their fertility.

In implementing control of the beet webworm, it is necessary to strictly abide by the entire set of measures stipulated in the "Methodological Instructions for Detection, Record-Keeping and Forecasting the Number of Beet Webworms, and Their Control" (Moscow, Kolos, 1976).

We should like to remind the readers that, according to these instructions, control of caterpillars of this pest in planted fields using chemicals and biological agents is effected only when insects appear in harvest-endangering numbers, in spite of preventive steps that were taken: more than 10 caterpillars per square meter for the first generation and more than 30-50 for the second. Treatment of 1st-3d age specimens is the most effective.

Among the pesticides, the following are recommended: 80% w.p. [wetting powder] (and crude) chlorophos (1.5-2 kg/ha), 30% w.p. metaphos (1.4 kg/ha), 40% e.c. [emulsion concentrate] metaphos (0.4-1 l/ha), 50% e.c. metathione (0.6-1.4 l/ha),

50% e.c. volaton (1.5 l/ha), 35% e.c. fozalon (3-3.5 l/ha), 12% d. [dust?] hexachlorane (12-15 kg/ha), and the biologicals, entobacterin (3 l/ha), bitoxybacillin (2-3 l/ha), dendrobacillin (1-2 l/ha). For spraying from the ground, 200-400 l/ha working fluid is recommended, 100 l/ha with use of spray deflectors and 50 l/ha for airborne spraying (from An-2 aircraft and Mi-2 and K-15 helicopters). Serious attention must also be given to proper determination of specified standard amounts of pesticide, adherence to recommended technology and proper preparation of working fluid. This makes it possible to obtain a high efficacy of exterminating work.

As to entomophages, the most extensive use should be made of the *Trichogramma* egg parasite to reduce the beet webworm population, particularly on vegetable crops and sugar beets. Let us recall that it is released twice. The first time during the period of mass flight of the webworm and start of egg deposition, in the presence of no more than 5 butterflies/m<sup>2</sup> (release is ineffective when there are more of them). When there is 1 butterfly/m<sup>2</sup>, 50,000 egg parasites are used per hectare, if there are 2--100,000, 3--150,000, 4--200,000 and 5--300,000/ha. They are released the second time during the period of mass scale deposition of eggs and depending on their number: 20,000-25,000 *Trichogramma*/ha when there are up to 20 ovipositions/m<sup>2</sup>, 100,000 *Trichogramma* with up to 40 and 150,000/ha with up to 50 ovipositions.

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CSO: 1840/1078

## BIOCHEMISTRY

### WIDE RANGE OF EXHIBITS AT INTERNATIONAL BIOCHEMISTRY EXPOSITION

Moscow LENINSKOYE ZNAMYA in Russian 17 Jun 84 p 4

[Article by A. Ruvinskiy, "From Molecules to Cosmetics"]

[Text] On June 25 in Moscow at the Exposition Complex at Krasnaya Presna the Biochemistry 84 International Exposition opened.

I did not clearly see what was mixed there in the flask, a fluid of some sort and, scientifically, a cellular suspension. Basically, then it was a cell. These cells themselves are sometimes very capricious: they butt into each other, collide with one another, and sometimes, on the other hand, they move about quietly and gradually, each in its own trajectory. The trajectory of movement of the cells and their other characteristics (i.e., electrical as well as their dimensions) are often very interesting to biologists, biochemists and physicians: the condition of the body is even determined according to them. Is it possible to measure and analytically evaluate the parameters of a cell?

"It is possible," confirm specialists of the All-Union Scientific Research Institute of Applied Microbiology. "We brought an EAK-1 [electrooptical cell analyzer] apparatus to the exposition. With the help of electrooptic measurements, the device determines polarizability of cells and their electrical parameters, and restores the average dimension of cells." The flask with the suspension was placed in a measuring system and after a second the computer, having processed the information, displayed it on the screen.

"Such a characteristic of cells and macromolecules as heat capacity is no less important," says the person at the stand, and he points to an apparatus set up nearby. This is a DASM-4 differential adiabatic scanning microcalorimeter. It measures the difference in heat capacities precipitated or absorbed in the calorimetric chambers which are protected from external influences by a heat screen. A signal proportional to the difference in heat capacities is transformed into a temperature and registered either on an automatic recorder or on a numbered display.

It is desirable to enrich fodder for animals with microbial protein, fats and vitamins, so that it might be useful and nutritious, but how to enrich it? Scientists at the USSR Academy of Sciences Scientific Center for Biological Research (Pushchino) have developed for these purposes a method of cultivating microorganisms in a solid substrate. They used sawdust, straw and grass meal as a solid substrate. Domestic animals will certainly like this enriched fodder.

The specialists from Pushchino also brought many biochemical instruments to the exposition, particularly a device for the sterile recovery of specimens. The "Serdtsse" device is a one-channel gas-liquid connector, one part of which is put into a vessel with the medium being tested and the other is joined by a rubber connecting piece to the test tube-sample collector. Both parts of the connector are equipped with valves. When reciprocal parts of the connector are attached, the valves are opened and a vacuum is created within the sample collector. A sample of the liquid being tested also goes into it at this time. There is no contact with the external surroundings; sterility is ideal.

The glass was grasped in tongs and tilted, the contents shared with a neighboring flask. But before the flask was a third full, the elastic tubing, prolapsed in it, reacted: the roller pump decided to pump out the liquid for further analysis of it, and the test tube with the solution residue was sent to be weighed. Meanwhile, no one present laid a hand on the glassware--everything was automated.

"But wouldn't it be simpler to do this by hand?"

"Simpler, yet a great deal longer and less exact. Moreover, researchers have more important things to do than to handle test tubes," says the president of the Institute of Biological Physics (Ukraine). "For this reason we decided to let automatic manipulators help the scientists. We programmed a number of traditional situations: suspension of solutions, decanting them and pumping them." He pushed the required button and the operation proceeded. Quickly, precisely (not even using the eyes!), and there is no need to look for a laboratory worker.

The sooner an illness is identified, the more chances there are to cure it. Early diagnosis of the most varied diseases is the goal of staff members' research at the BSSR Academy of Sciences Bioorganic Chemistry Institute. They have developed kits for the radioimmunological determination of hormones and other biologically active substances in human blood. The use of such kits enables early diagnosis of oncological, endocrine, gynecological and other diseases, control of the effectiveness of their treatment and also analysis of the physiological condition of the patient. Incidentally, there is a reagent in the kit which allows determination of the quality of cow's milk and the health of the cow itself.

But women were crowding around the Biokhimreaktiv Scientific and Industrial Association stand. Could these be cosmetics? Exactly, and the cosmetics are exotic: extract of flower pollen. The water soluble part of the extract contains all irreplaceable amino acids, vitamins, hormones and mineral substances. All these components protect the skin from harmful weather and toxic effects and forestall its aging, quickly healing wounds. A face cream and a substance for strengthening the hair have already been manufactured and tested. Next--the creation of new lotions, creams and lipsticks.

12262  
CSO: 1840/760

IMMUNOCHEMICAL STUDIES ON RETINAL PHOTORECEPTORS: ANTIBODIES AGAINST  
cGMP-PHOSPHODIESTERASE AND ITS PROTEIN INHIBITOR

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 6, Jun 84  
(manuscript received 5 Mar 84) pp 565-572

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[Abstract] Purified cGMP-phosphodiesterase (PDE) from bovine retinal photo-  
receptors was used to raise specific antibodies in rabbits for subsequent  
immunochemical characterization of PDE, and determination of its evolutionary  
spread. The specific antibodies were found to decrease the  $V_{max}$  of the  
enzymatic reaction without affecting the  $K_m$ , indicating that the catalytic site  
of PDE did not function as the antigenic determinant in this situation. Mono-  
valent Fab fragments of the antibody immunoglobulins were less efficient in  
inhibiting the enzymatic activity of PDE. Ouchterlony plates were used to  
demonstrate antigenically similar PDE in the retina of the pig and the rat,  
and the absence of such immunological cross-reaction with preparations derived  
from the frog and various bony and cartilaginous fish. However, nonprecip-  
itating antibodies in the IgG fraction were seen to inhibit the enzymatic  
activity of frog PDE and the PDE activity of two fish species. In addition,  
antibodies against a Bovine protein inhibitor of PDE were used in an immuno-  
affinity column to further purify the inhibitor and estimate its MW at 11500.  
Double radial immunodiffusion was also used to demonstrate inhibitor anti-  
genicity in the retina of the frog, pig and rat, but not in the retina of the  
tortoise, tested fish species, or various mallalian tissues (brain, heart,  
liver, olfactory mucosa). Figures 7; references 20: 10 Russian, 10 Western.  
[1566-12172]

EXTERNAL PATHWAY OF NADH OXIDATION IN HEPATIC MITOCHONDRIA IN  
HYPERTHYROID RATS

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 6, Jun 84  
(manuscript received 9 Dec 83) pp 573-579

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[Abstract] Outbred female rats were used to study the effects of hyperthyroidism and cold adaptation on the external pathway of NADH oxidation in hepatic mitochondria. Animals receiving daily administration of thyroidin (300 mg/100 g) for 4-5 days and maintained at 4°C for 8-10 h/day showed markedly enhanced rate of NADH oxidation by pathways insusceptible to Amytal or antimycin A inhibition (i.e., external pathway). The rate of oxidation was further enhanced if the animals were kept at 4°C for 15 min prior to decapitation. In a phosphate buffer the rate of NADH oxidation by the external pathway increases 1.5-fold as the pH is lowered from 7.4 to 7.0, and is also enhanced by the addition of 20 μM of palmitate or oleate. However, addition of 0.5 to 2 mM Mg<sup>++</sup> to the incubate decreases external NADH oxidation. The conditions under which external oxidation of NADH is enhanced are identical to those which favor Ca<sup>++</sup> release from mitochondria. The effects are reproducible, and show that even short-term cold adaptation and thyroidin administration are sufficient to activate the external pathway. Such activation and NADH oxidation may lead to an increase in hepatic temperature, and facilitate heat production by the animal subjected to cold. Figures 1; references 24: 15 Russian, 9 Western [1566-12172]

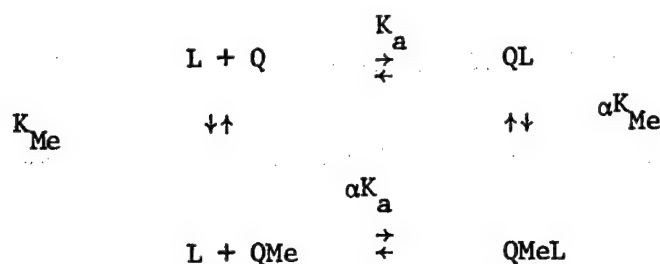
EFFECT OF DI- AND TRI-VALENT METAL IONS ON COMPLEX FORMATION PROCESS OF  
[<sup>3</sup>H-Tyr<sup>1</sup>, D-Ala<sup>2</sup>, D-Leu<sup>5</sup>]ENKEPHALIN WITH OPIATE RECEPTORS OF RAT BRAIN

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 4 Nov 83) pp 902-911

PORODENKO, N. V., ZAYTSEV, S. V. and VARFOLOMEYEV, S. D., Interdepartmental  
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M. V. Lomonosov

[Abstract] The goal of the present work was to study the mechanism of the effect of metal cations (Ca<sup>++</sup>, Mn<sup>++</sup>, Sr<sup>++</sup> and lanthanides) on the binding process with opiate receptors [<sup>3</sup>H-Tyr<sup>1</sup>, D-Ala<sup>2</sup> and D-Leu<sup>5</sup>]enkephalin. It was concluded that the following mechanism was most likely:





where Q - binding centers, Me - metal ions,  $K$  - constant of ligand affinity to receptor in absence of metal ions,  $K_{Me}$  - metal ion association constant with free binding centers and  $\alpha$  - parameter characterizing the effect of complex formation on the constant of center affinity to the ligand. In addition, analysis of data led to following conclusions: 1) high affinity binding centers of enkephalin show no specificity towards the action of metal ions; in presence of all ions  $K_{d1}$  decreases while the total concentration of high affinity center did not change; 2) the cations studied (except for  $Ca^{++}$  and  $Sr^{++}$ ) acted specifically on the low affinity center of enkephalin binding decreasing  $K_{d2}$ ;

3) the values of  $\alpha$  parameter were about the same for each binding center and all cations; 4) the cations could be grouped as follows: those with no effect on low affinity binding center ( $Ca^{++}$  and  $Sr^{++}$ ) and those affecting it (all the other ions studied). It was concluded that different effects of these groups is due to different physiological action of these cations. Figures 7; references 23: 4 Russian, 19 Western.  
[1569-7813]

UDC 577.152.313'2:543.544:547.1'128

# LIGAND EXCHANGE CHROMATOGRAPHY OF ENZYMES. 1 COMMUNICATION. SYNTHESIS OF CHELATING SORBENTS AND PURIFICATION OF EXONUCLEASE A5 FROM ACTINOMYCES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 29 Nov 83, after revision 30 Jan 84) pp 927-934

VARLAMOV, V. P., LOPATIN, S. A. and ROGOZHIN, S. V., Institute of Metal Organic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow

[Abstract] Ligand exchange chromatography (LEC) is based on reactions of substances being separated with the stationary phase leading to formation of coordination bonds in the coordination sphere of the complex forming metal ion. Synthesis of chelate sorbents based on silochrome and organic sorbent TSK-Gel HW-55 (TSK) is described. The application of the TSK based chelating sorbent in the  $Na^{++}$  form in purification of exonuclease A5 from actinomyces is discussed. Immunodiacetic acid groups were chosen as the basic stationary ligands as they formed strong chelating complexes (1:1) with metal ions. Sorbents

based on a hydrophilic organic carrier TSK-Gel Toyopearl HW-55 were stable throughout the entire range of pH and showed low nonspecific binding of proteins and metal ions. In presence of  $Zn^{++}$  ions the enzymes lost considerable portion of their activity. Therefore, for the purification of exonuclease A5 the  $Ni^{++}$  form of the sorbent was used effectively. Figures 2; references 15: 8 Russian, 7 Western (1 by Russian authors).  
[1569-7813]

## BIONICS

### MACHINE MECHANICS INSTITUTE BUILDS WALKING VEHICLE

Moscow IZVESTIYA in Russian 23 Aug 84 p 2

[Text] Tbilisi -- Georgian scientists have developed a cross-country vehicle which walks, rather than rolling.

The driver started the engine and pressed a button, and the vehicle slowly walked out of the garage and then began to stride along the lane around the building of the Georgian Academy of Sciences' Institute of Machine Mechanics. Its iron legs moved up and down smoothly. The walking vehicle is controlled by only three buttons: the middle button gives the command to go straight ahead, while the left and right ones determine the directions of turns.

"After inventing the automobile, man continued to dream about a reliable and universal means of transportation suited for roadless conditions," said the vehicle's designer Candidate of Technical Sciences B. Petriashvili. "The first multiple-surface cross-country vehicles made their appearance in our country as early as the thirties. Their general principle of locomotion was on wheels over roads, and by means of tracks and rotary auger systems over roadless terrain. We decided to build a 'mechanical mule' -- a vehicle that can walk along mountain paths. Many advances in electronics, biomechanics, machine science and computer technology were utilized in its design. Hydraulic systems --the vehicle's 'muscles'--are activated on command of an electronic device. The vehicle is automatically maintained in a horizontal position even when it moves over very rugged terrain.

"Now the task at hand is to teach this vehicle also how to roll. For this purpose, wheels will be installed on the metal legs, which resemble the landing gear of an airplane. By means of a special hinge mechanism, it will be possible, when necessary, to rotate the wheels into a flat position, forming a 'foot' with a large surface. This, by the way, will help the vehicle to move better over ground that is not firm.

"Such a cross-country vehicle will roll on a good road like an automobile--it is equipped with a kinematic system similar to that of a motorcycle. But over swamps, tundra and mountains it will walk, transporting a substantial load."

FTD/SNAP

CSO: 1840/818

UDC 541.144.7

ATP-DEPENDENT  $\text{Ca}^{++}$  UPTAKE BY MEMBRANOUS SYSTEMS OF RETINAL RODS

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 6, Jun 84  
(manuscript received 23 Jan 84) pp 651-658

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[Abstract] Dark-adapted bovine retina were used to prepare homogenates and isolate mitochondrial, microsomal, and disk fractions from the rods to study ATP-dependent  $\text{Ca}^{++}$  uptake. Analysis of the different membrane preparations showed that the mitochondrial fraction was most active, followed by the microsomal fraction, and finally the disks.  $\text{Ca}^{++}$  uptake by the disks involves an autonomous system in which the  $\text{Ca}^{++}$  transport is regulated by calmodulin, cGMP and  $\text{Na}^+$ . In view of  $\text{Na}^+$ -dependence, it appears that the disk system involves sodium-calcium exchange in which excess  $\text{Na}^+$  inhibits  $\text{Ca}^{++}$  uptake. Figures 4; references 33: 7 Russian, 26 Western.  
[1566-12172]

UDC 577.352.26

REVERSIBLE ELECTRICAL BREAKDOWN OF BILAYER LIPID MEMBRANES

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 3, Mar 84  
(manuscript received 14 Jul 83) pp 229-243

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[Abstract] Voltage-clamp technique was employed to study the reversible electrical breakdown of bilayer lipid membranes (BLM) constructed of oxidized cholesterol or  $\text{UO}_2^{++}$ -modified azolectin. Analysis of the oscillographic data showed that application of a 20  $\mu\text{sec}$  700 mV impulse to the cholesterol membrane, with a capacitance of ca. 0.5  $\mu\text{F}/\text{cm}^2$ , results in a gradual increase in conductance which, at the end of the 20  $\mu\text{sec}$  interval, approached  $10^{-6}$  to  $10^{-5}$  ohm $^{-1}$ , representing a  $10^4$  to  $10^5$ -fold increase over a baseline value of  $10^{-10}$

to  $10^{-9}$  ohm $^{-1}$ . Lifting the applied potential results in a rapid (less than 5  $\mu$ sec), reversible decrease in conductance. Analogous results with other voltages and with the  $UO_2^{++}$ -modified azalectin BLM, and the fact that the BLM was irreversibly damaged<sup>2</sup> by prolonging the impulse to 40  $\mu$ sec, and effects of monovalent ( $K^+$ ,  $NO_3^-$ ) and divalent ( $Ca^{++}$ ,  $SO_4^{2-}$ ) ions and blocking agents (sucrose, hemoglobin) on changes in conductance, indicated that the effects were due to an increase in the number and diameter of conducting pores. Figures 10; references 30: 5 Russian, 25 Western. [1563-12172]

UDC 547.898

#### MEMBRANE-ACTIVE NOVEL ALKYL-SUBSTITUTED BENZO- AND DIBENZOCROWN ETHERS

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 3, Mar 84  
(manuscript received 29 Sep 83) pp 273-280

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[Abstract] Novel alkyl-substituted benzo- and dibenzo- crown ethers were tested for their membrane-active properties by evaluating their effects on rat liver mitochondria, bilayer lipid membranes from bovine white matter, liposomes prepared from egg lecithin, sarcoplasmic reticulum from white muscle of rabbit, and human erythrocytes. The 27 new compounds differed in the size of the macrocyclic inner cavity and on the number and kind of alkyl groups on the benzene ring. The greatest  $K^+$  ionophoric activity was shown by trans-diamyldibenzo-18-crown-6 which, within a concentration range of 0.25-0.50  $\mu$ M, yielded a  $K^+/Na^+$  selectivity value of 20. Superior  $K^+/Na^+$  selectivity was exhibited by diethyldibenzo-30-crown-10 (ca. 150), while the di-sec-butyl analog of dibenzo-18-crown-6 was found to be an effective  $Mg^{++}$  ionophore for mitochondrial and bilayer lipid membranes ( $Mg^{++}/Ca^{++}$  selectivity of 4.8). In a concentration of 50  $\mu$ M, the latter also increased 1.5-2-fold the rate of  $Ca^{++}$  transport in sarcoplasmic reticulum. The structure-activity relationships showed that ionophoric activity requires 18- or 30-membered macrocycles with two symmetrically located benzene rings carrying 3-5 carbon atom alkyl substituents. References 22: 11 Russian, 11 Western. [1563-12172]

PHOTOPOTENTIALS AND ELECTRIC FIELD-CONTROL OF BACTERIORHODOPSIN  
PHOTOCYCLES IN HIGHLY ORIENTED PURPLE MEMBRANES OF HALOBACTERIUM HALOBIVM

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 3, Mar 84  
(manuscript received 8 Jul 83) pp 294-304

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[Abstract] Purple membranes isolated from Halobacterium halobium were electrophoretically sedimented in multilayered form, with a high degree of orientation, on current-conducting support plates for photoelectric studies. Steady-state illumination of the preparation resulted in the development of electric potentials approaching 10 V, with the active spectrum coinciding with the absorption spectrum of bacteriorhodopsin. The photopotentials recorded from the oriented membranes exceeded by one- to two-orders of magnitude analogous potentials obtained from unordered membranes, and their sign indicated that the cytoplasmic surface of the membranes was adjacent to the support surface. Dark polarization of an applied electric field induced a bathochromic shift in the bacteriorhodopsin absorption band when it coincided with the internal field in the multilayered sheets, while an external field corresponding to the positive potential on the cytoplasmic surface inhibited decomposition of component  $M_{412}$ .

As a result, the stationary concentration of  $M_{412}$  increased, and it appears that the rate of the photocycle is under the control of the electric field responsible for  $M_{412}$  decomposition. Figures 7; references 21: 5 Russian, 16 Western.

[1563-12172]

UDC 577.352.465+612.42

MEMBRANE POTENTIAL OF HUMAN PERIPHERAL BLOOD LYMPHOCYTES: EFFECTS  
OF IONOPHORE A23187 AND CONCAVALIN A

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 3, Mar 84  
(manuscript received 7 Jul 83) pp 317-324

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[Abstract] The effects of the calcium ionophore A23187 and concanavalin A (conA) on the surface potential of human peripheral blood lymphocytes were followed by measurement of the potential-dependent change in the fluorescence of the probe 3,3'-dipropylthiodicarbocyanine. High concentrations of the

ionophore (ca.  $3 \times 10^{-6}$  M) resulted in hyperpolarization, while lower concentrations led to depolarization of the lymphocyte membrane; both electrical phenomena were calcium-dependent. Furthermore, since the ionophore-mediated hyperpolarization was abolished by raising the external  $K^+$  concentration, and was also blocked by quinine and valinomycin but not by ouabain, it appears that hyperpolarization was due to enhanced  $K^+$  conductance. Therefore, it seems that the lymphocyte plasma membrane has  $Ca^{++}$ -dependent  $K^+$  channels that can be affected by A23187. Since the depolarization effect of A23187 was abolished by removal of  $Na^+$  from the bathing medium, it is evident that it is dependent on the influx of  $Na^+$ . Mitogenic concentrations (5-50  $\mu\text{g/ml}$ ) of conA had no effect on the membrane potential, while higher concentrations (150-200  $\mu\text{g/ml}$ ) had a weak depolarizing effect. Figures 8; references 29: 2 Russian, 27 Western.  
[1563-12172]

## BIOTECHNOLOGY

### COMBATING OIL POLLUTION

Novosibirsk TASS International Service in Russian 0750 GMT 22 Aug 84

[Text] Novosibirsk, 22 Aug (TASS)--Soviet scientists of the West Siberian Geological Prospecting Research Institute have created a biological preparation which clears up accidental oil spills very quickly and restores soil fertility.

Exploration and extraction of oil is accompanied all over the world by oil spills. People have not learned to do it otherwise. That is why the search is on for the most effective ways to eliminate the consequences of spills.

A specialized laboratory has been set up at the West Siberian institute to work on the problem of eliminating oil pollution, and restoring and preserving the soil, says Ivan Nesterov, corresponding member of the USSR Academy of Sciences, director of the institute. The bacteriological method of eliminating oil pollution is the most promising one. There are many bacteria which eat oil. But as a rule, they do not consume it all, and also they cannot be acclimatized everywhere.

The laboratory has bred a strain able to withstand the temperature variations of the Siberia climate. It also works 100 times faster than the strains used everywhere.

An experimental trial has given good results. At a site polluted in the proportions of 10 kg of oil per square meter, grass cover appeared in place of an oily brown desert after 2 and a half months of treatment with the new preparation.

Using the new strain, the soil can be recultivated after suffering very considerable pollution. The costs, as compared with methods normally used, are reduced by a factor of 15. The strain can be employed in a wide temperature range. The bacteria are active and viable from -50 to +70 degrees Celsius.

CSO: 1840/802



## SOME PROBLEMS OF BIOTECHNOLOGY

Moscow ZHURNAL MIKROBIOLOGII EPIDEMIOLOGII I IMMUNOBIOLOGII in Russian No 7,  
Jul 84 pp 26-29

[Article by V. M. Zhdanov, Institute of Virology, USSR Academy of Medical Sciences]

[Text] Genetic engineering is one of numerous areas of specialization in modern biotechnology.

It has been ten years since the first publication of P. Berg [8] on producing a recombinant DNA molecule by chemical manipulation--a biological hybrid, which heralded the birth of a new direction in molecular biology and genetics and a new field of biotechnology--gene, or genetic engineering. The birth of genetic engineering was a boisterous and vigorous one because its founders declared at international conferences at Palomar [7] and Asilomar [8] that genetic engineering entailed the possible danger of creating synthetic organisms which might alter the earth's ecology with unpredictable results, or that ultra-hazardous bacteriological weapons as well as many other things might be created. The sorrowful experience gained in utilizing achievements in nuclear physics in the USA offers sufficient grounds for those fears. But there was another reason for such vigorous discussion--the desire to attract the attention of industrial firms to a new area of specialization in biotechnology. And all that publicity worked. Firms began to invest tens, hundreds, and millions of dollars into genetic engineering projects [1] which have now become secret projects in the USA and other capitalist countries not only because military agencies have taken an interest in them, but primarily because the industrial firms have sensed the possibility of profits.

Now, ten years after the birth of genetic engineering, it would seem to be a most appropriate time to appraise what has been accomplished and what is planned for the immediate future. This would seem advisable because significant funds are being allocated to the development of new directions in biotechnology, including genetic engineering, thanks to the Party and Government decrees that have been made public.<sup>1,2</sup> Recent reports on human interferon

<sup>1</sup> PRAVDA, 21 May, 1974

<sup>2</sup> PRAVDA, 30 June, 1981

that has been produced in bacteria by genetic engineering methods [3,4] are indicative of the worthy place we are taking in the resolution of problems in this area, although it would be desirable if we could more quickly overcome manufacturing difficulties and set up the industrial production of human interferon prepared by genetic engineering methods with the use of bacterial producers.

We shall dwell only on the small area of utilizing genetic engineering methods for practical purposes--the production of viral vaccines.

But first, a few words about the subject and methods of genetic engineering.

In contrast to methods of classical genetics, in which new organisms are produced by means of hybridization and selection, genetic engineering methods are based on the manipulation of genes as one would manipulate chemical substances--as fragments or complete molecules of DNA. The essence of these manipulations is to separate the gene that is of interest to us, for example, the HB<sub>s</sub>Ag gene of the hepatitis B virus or the hemagglutinin gene of the influenza virus, then incorporate it into a vector which can either be another virus or, more often than not, virus-like structures such as plasmids that are propagated in bacterial, yeast cells or cells of higher animals. The first operation is the separation of the gene which is accomplished with the aid of special enzymes--restrictases--that not only split a section of DNA into a random heap of fragments, but also shave off the gene we seek. If this gene is RNA, as is, for example, the gene of the influenza virus hemagglutinin, it is then transformed to a DNA form with the aid of another reversible polymerase enzyme, or revertase. The isolated gene we have produced in this manner is then incorporated into a plasmid or virus with the aid of the enzyme ligase. But that is not all. We must affix to each gene a structure that regulates its work and whose basic component is a so-called promotor which, with the aid of DNA-polymerase, provides for the synthesis of a gene copy--informational RNA--which will be supplied to the ribosomes where the appropriate protein will be synthesized, in this case, a viral antigen.

Even such a simplified description of genetic engineering manipulations demonstrates their complexity, so that one should not be surprised that in the course of ten years a technology has not yet been worked out to produce even a single viral vaccine by genetic engineering methods, even though there have been many promises and publicity claims along these lines.

But these are far from all the difficulties, and not even the main ones. The basic idea of producing vaccines by genetic engineering methods is to use bacteria--E. coli or hay bacillus--as producers of viral antigens instead of the costly chick embryos or cellular cultures. As a matter of fact, it would be tempting not to waste hundreds of millions of chick embryos or tens of tons of expensive nutrient media and many thousands of green marmoset kidneys for making influenza or poliomyelitis vaccines, but instead, substitute all of that by reactors in which one could cultivate E. coli which produces the hemagglutinin of the influenza virus or the protective antigen of the poliomyelitis virus.

Unfortunately, the road to accomplishing that dream is blocked not only by technological obstacles which have already been mentioned above, but also by biological obstacles. Here are some of them.

The mechanisms underlying the synthesis of proteins in bacteria and in human and animal viruses are marked by important differences that are related to the fact that human and animal viruses over the long course of evolution have become adapted to a parasitic existence in the animal and human body so that, for example, the influenza virus cannot reproduce in *E. coli*.

Let us see how complex is the synthesis of influenza virus hemagglutinin [13]: At first a long polypeptide chain is synthesized which is then transported to the cellular membrane by a so-called signal peptide that consists of 15 amino acid remnants. In this process the proteolytic enzymes of the cell split the polypeptide chain into two fragments--a large and small subunit of hemagglutinin--joined by disulfide. Simultaneously, the newly formed molecule of hemagglutinin is coated by a shell of polysaccharide chains that give it the essential hardness and protection against cellular proteases. The aforementioned signal peptide, after having run through the cellular shell of the hemagglutinin molecule, splits off and is destroyed by cellular enzymes. The hemagglutinin itself becomes fixed in the lipid layer by its own "anchor" sector. But this still is not all: Three hemagglutinin molecules of the influenza virus form a trimer--a final structure that has essential immunizing properties. If this trimer is again divided into molecules, the immunizing properties are reduced by 1000 times and more [9].

We have dwelt in detail on the process underlying the formation of influenza virus hemagglutinin in order to show that modern genetic engineering, while being capable of overcoming technological difficulties, in this case is not capable of breaking the biological barrier. The synthesis of genuine influenza virus hemagglutinin in bacterial or yeast systems has simply been impossible. There have been no kinds of clever genetic engineering devices capable of breaking the biological barrier in this case. The production of influenza virus hemagglutinin by genetic engineering methods is possible only in the cells of higher animals--the mammals and birds. However, this would simply be inexpedient since it will always be simpler and cheaper to produce it by the usual means--by means of injecting chick embryos. And even if this would require very many of them, it would still be cheaper to build two or three large poultry farms than waste thousands of tons of medium No 199 or Igel's medium for cultivating bird or mammalian cells.

Unfortunately, most protective antigens of viruses are products of complex synthesis processes that are impossible to reproduce in bacterial or yeast systems. Such systems include, in particular, protective antigens of such important viruses as the poliomyelitis virus, and probably, the hepatitis A virus [10].

But does this mean that genetic engineering is generally useless when it comes to making viral vaccines? No!

Let us briefly outline prospective uses of various systems for producing viral vaccines.

1. Bacterial Systems. In these systems it will definitely be possible to synthesize relatively simple proteins such as the internal proteins M and NP of the influenza viruses and the related internal proteins of the paramyxo- and rhabdoviruses. Here, numerous bacterial plasmids might be utilized as vectors for corresponding genes of the indicated viruses. The inexpensive synthesis of these proteins in bacterial systems has clear advantages over their production from virions synthesized in chick embryos (influenza viruses) or tissue cultures. Broad applications of these proteins might be found in the diagnosis of the indicated infections along with the use of immuno-enzymatic or radio-immunological methods.

2. Yeast Systems. These systems should be used for producing vaccines by genetic engineering methods for protection against hepatitis B.

In spite of the fact that samples and even industrial series of a vaccine prepared from HB<sub>s</sub>Ag and isolated from carriers have been produced both in the USSR and abroad, these vaccines show little promise. Control of those vaccines requires a massive utilization of chimpanzees which is not feasible. Besides, if these vaccines were to be widely used, by the same token their unique raw source base which contains the blood of HB<sub>s</sub>Ag carriers would subsequently be narrowed.

In the meantime there are grounds for assuming that the indicated vaccines should find broad application at least in certain regions, so that the problem of producing them is a fully vital one.

Data in the literature [12] and data obtained in our laboratory [2] allow us to conclude that there is great promise for using yeasts for producing the HB<sub>s</sub>Ag gene that is included in yeast plasmids and supplied by their own or by yeast promoters. Of course, there is a long way to go to get from these experimental stages to the commercial production of the vaccine. If one were to divide that process into three conditional stages--the production of recombinant molecules, their expression, and the working out of the required technology, the efforts required for those stages would be 10%, 30%, and 60% respectively. At the present time we have traversed approximately 12-15 percent of this path.

3. Systems of Higher Eukaryotes (cultures of mammalian and avian cells). As was mentioned earlier, these systems are expensive since they require the cultivation of cell cultures on costly media. Therefore, for example, there would be no sense to developing this kind of a vaccine for influenza prophylaxis.

However, the situation is different when it comes to hepatitis A. Although there are already available attenuated strains of the hepatitis A virus that are cultivated on intertwined cells [11], the control problem of such a vaccine remains a complex one. In poliomyelitis, the live vaccine must be constantly guarded against any signs of neurotropism, and the same applies to vaccines against hepatitis A, only in the latter case hepatotropism must be controlled, i.e., make sure that the attenuated virus cannot reverse itself and induce the development of jaundice in the persons vaccinated. And here

again we require susceptible animals--chimpanzees or marmosets, which limits the possibility of mass-producing a hepatitis A vaccine. And we know that the call for its use is no less broad than for the poliomyelitis vaccine [14]. The only problem is that there isn't any mass vaccine against hepatitis A, and none is foreseen if this problem is not going to be solved by genetic engineering methods alone.

Unfortunately, we are still at the very beginning of the road because much remains unclear, beginning with the localization of the protective protein genes and ending with the mechanism underlying their assembly in the cell. Nevertheless, maximum efforts should be made to develop this area of research.

4. Vaccines from Antigen Determinants. There is one more aspect in the use of genetic engineering for making viral vaccines. In the ordinary protective antigen molecule there is a small number of antigen determinants which in turn contain from six to ten amino acid residues that are surrounded on both sides by five to ten more amino acid residues [5]. One cannot produce or synthesize the entire protein, but only its fragments that are coded by 50-80 nucleotides. Such sectors of a genome can be separated with the aid of restrictase or produced by the chemical synthesis of the corresponding oligopeptide chains. However, short oligopeptide chains are not very immunogenic, and special methods are required to increase their immunogenicity. Some of these paths are yielding encouraging results.

Therefore, by utilizing new systems of producers and new operational methods, genetic engineering holds broad prospects for making viral vaccines and preparations for diagnosing viral infections. However, the realization of those prospects requires considerable efforts, so it would be premature to reject both the traditional vaccines and the sanitation and anti-epidemic measures that still remain the only realistic ones in the struggle against such infections as viral hepatitis.

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CSO: 1840/1594

UDC 616.921.5-085.371/.372-084:616-036.22. "1980-1983"

EFFECTIVENESS OF VACCINE PROPHYLAXIS OF INFLUENZA AT INDUSTRIAL ENTERPRISES DURING EPIDEMICS OF 1980-1983

Kiev VRACHEBNOYE DELO in Russian, No 7, Jul 84 (manuscript received 2 Apr 84) pp 122-123

[Article by A. V. Slobodenyuk, Yu. I. Vaserin, I. A. Mal'chikov, T. A. Lazareva, Ye. A. Andreyeva, G. A. Myalitsina and I. P. Pestova (Sverdlovsk), Scientific Research Institute of Viral Infections of the RSFSR Ministry of Health]

[Text] The modern scientifically substantiated complex of protective measures against influenza includes vaccinal prevention, chemoprophylaxis, implementation of antiepidemic measures and treatment at the early stage of the disease (G. I. Karpukhin, 1981). Studies confirmed the epidemiological effectiveness of the integrated measures for the protection of workers and employees of industrial enterprises against influenza (S. A. Ivanova, V. M. Gagarinova, 1981; L. Mukhina, N. Kozlova, Z. Yershova et al, 1979).

Planned vaccinal prevention is the main means in the complex of antiepidemic measures for preventing the population against influenza, and the criteria of the evaluation of its effectiveness during years differing with respect to the epidemiological situation are important (G. I. Karpukhin, 1981; G. I. Karpukhin, S. S. Golitorov, 1981).

This work evaluates the epidemiological effectiveness of using an inactivated influenza vaccine at two machine-building enterprises (No 1 and No 2) in Sverdlovsk in 1980-1983.

Vaccination during the preepidemic period of 1980-1981 was done with an inactivated chromatographic vaccine (IGKhV) prepared from strains of viruses of influenza A (Texas) 1/77 A-H3N2 and A (Leningrad) 54/I-H1N1; in 1981-1982 -- inactivated centrifuged vaccine (IGTsV) from strains A (Texas) 1/77 A-H3N2 and A (NIB-6)-H1N1, and in 1982-1983 -- inactivated chromatographic vaccine from strains A (Leningrad) 385/80R-H3N2 and A (Leningrad) 54/IR-H1N1.

The preparation was administered intracutaneously to the workers with a needleless injector BI-3 at 6 µg of hemagglutinin. Inoculations were conducted in different years, with the exception of the control groups, which constituted 89-93% of the workers.

Groups for observation were formed by the method of random selection at shops of the same type; a sick worker was the unit of observation in the selected group.



The workers of the control groups were vaccinated with placebo (apyretic physiologic salt solution).

During the epidemic seasons of 1980-1983, the total ORZ [acute respiratory diseases] and influenza incidence were registered among the vaccinated workers in the course of six months (from October to March of the following year).

In 1980-1981 (October-March), according to the data of serovirological and immunofluorescence studies, the main etiological factor of the growth of incidence of respiratory infections among the population of Sverdlovsk was B influenza virus which caused up to 20.7% of cases among ORZ cases. During this period, A (H1N1) and A (H3N2) influenza viruses accounted for 18.8% of confirmed cases. Adeno-parainfluenza and RS infections were diagnosed in a total of 20.6% of cases.

During the epidemic season of 1981-1982, when A and B influenza viruses continued to circulate causing illnesses respectively in 10.9% and 1.5% of cases, a substantial role in the etiology of ORZ was played by parainfluenza viruses (26.1% of cases) and adenoviruses (12.6% of cases).

The epidemic season of 1982-1983 did not differ substantially from the preceding period with respect to the circulation intensity of respiratory viruses. Illnesses caused by A influenza virus were confirmed in 5.1%, B influenza -- in 1.3%, and parainfluenza -- 20.0%. Adenoviral infections were registered in 13.8% of the total number of examined persons. Therefore, the evaluation of the true prophylactic effectiveness of inactivated influenza vaccines presented definite difficulties against the background of polyetiologic structure of ORZ and a relatively low percentage of influenza during the three years of observation.

The immunogenic activity of the vaccines in vaccinated persons was determined in two sera taken before vaccination and 21 days after vaccination. The content of antibodies to homologous strains A (H1N1), A (H3N2) and B influenza virus, which was not contained in the vaccine, was established in the sera.

It can be seen from the results of these studies that inactivated vaccines are characterized by a high immunogenic activity. They brought about seroconversions in vaccinated persons to A (H1N1) strain in 52.3-59.0% of cases and to A (H3N2) strain -- in 42.6-62.0% of cases. Persons with a protective antibody titer (1:40 and higher) in the observed groups vaccinated against A (H1N1) virus constituted 76.8-82.0%, and against A (H3N2) virus -- 75.6-87.0%. It was established at the same time that in the groups which were vaccinated with the vaccine and placebo in different years, seroconversions to B influenza virus were revealed in 2.0-14.0% of the observed persons. There were 66.0-78.0% with a protective antibody titer for this virus among the observed groups.

According to the results of epidemiological observations, the total influenza and ORZ incidence in six months of each epidemic season at the enterprise No 1 among vaccinated persons was 1.3-1.5 times lower than among those vaccinated with placebo. At the enterprise No 2, the index of prophylactic effectiveness of inactivated vaccines in different years was within the limits of 1.2-1.7.



According to serological tests, the number of persons with protective antibody titers for A influenza viruses after vaccination was quite large. Consequently, they should be protected against influenza. However, the obtained results of the evaluation of prophylactic effectiveness of inactivated vaccines were considerably lower than was expected, which is evidently connected with a small proportion of influenza in the structure of ORZ during the years of observation.

The obtained data were used for determining the economic effectiveness of vaccination as a measure directed toward the preservation of labor resources. Calculations performed jointly with the Institute of Economics of the Ural Scientific Center of the USSR Academy of Sciences (Professor I. P. Mokerov) indicated that: due to the reduction of labor losses among the workers vaccinated against influenza, the economic effect at two enterprises in six months of 1980-1981 amounted to 631,148 rubles and for the same time in 1981-1982 -- 596,749 rubles.

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CSO: 1840/1094

## GENETICS

### GENETIC ENGINEERING RESEARCH AT INSTITUTE OF ORGANIC SYNTHESIS

Riga SOVETSKAYA LATVIYA in Russian 24 Jul 84 p 4

[Excerpt] Research in the field of genetic engineering has been advanced in Soviet Latvia. Such projects have solidly determined the activities of the nucleic-acids laboratory of the Latvian Academy of Sciences' Institute of Organic Synthesis. This work is headed by Doctor of Chemical Sciences, Professor Elmar Gren. Both theoretical and applied problems are being solved in his laboratory; protein preparations which are important for medicine are being developed by methods of genetic engineering. Among these preparations are biological agents for the diagnosis of hepatitis B, and leukocytic interferon which is effective against the most dangerous viral infections. These preparations are produced by microorganisms, which are made to do this by new genes artificially built into their living cells.

(A photograph is given showing Candidate of Chemical Sciences Valdis Berzin', senior science associate, conducting research with a scintillation counter.)

FTD/SNAP

CSO: 1840/785

OVCHINNIKOV'S GENETIC ENGINEERING WORK SALUTED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 3 Aug 84 p 3

IL'INSKAYA, N.

[Abstract] The article is published on the occasion of the 50th birthday of Yuriy Anatol'yevich Ovchinnikov, vice-president of the USSR Academy of Sciences and head of a laboratory of the academy's Institute of Bioorganic Chemistry. A number of Soviet and foreign scientists are quoted in regard to Ovchinnikov's pioneer contributions to Soviet biochemistry and exemplary personal traits. Ovchinnikov and scientists working under his direction are credited with original work in the field of genetic engineering, including development of bacteria-containing genes which control the synthesis of interferon. It is recalled that Ovchinnikov was awarded the Lenin Prize for work on the development of a new class of membrane bioregulators and research on molecular principles of ionic transport through biological membranes. Research on unique properties of bacterial rhodopsin and their prospective uses is mentioned as a current direction of his work.

FTD/SNAP

CSO: 1840/818

## HUMAN FACTORS

### 'RECH'-1' SPEECH SYNTHESIZER FOR MAN-MACHINE DIALOG

Moscow PRAVDA in Russian 2 Sep 84. p 6

GUSEV, O.

[Abstract] The article reports on features of the "Rech'-1", an electronic device which can synthesize speech as well as comprehend it. The device was developed by personnel of the Minsk branch of the Central Scientific Research Institute of Communications, and the Ukrainian Academy of Sciences' Institute of Cybernetics imeni Glushkov, whose director is V. Mikhalevich, a member of the Ukrainian academy. It is mentioned that the device aroused much interest at an All-Union seminar, "Automatic Recognition of Auditory Images", which was held in Novosibirsk.

The "Rech'-1" is intended for spoken dialog with computers. In practice, the system reportedly is capable of functioning as an intermediate link between operators and large computers which control production processes or the automation of design work.

An account is given of a dialog using the "Rech'-1", during which engineer S. Bidnyuk and T. Vintsyuk, head of a laboratory of the cybernetics institute, described and demonstrated its capabilities. The system is said to be capable of responding to 200 command words and of synthesizing speech from a printed text, in both Russian and Ukrainian. To enable the device to understand spoken commands, a unit was developed which produces graphic representations of spoken words on paper. To prepare the "Rech'-1" to understand his commands, an operator has to pronounce each word into a microphone only once, according to senior project engineer A. Shinkazh. Each word is recorded in an on-line storage. An individual 'data bank' of sound images is thus created for each speaker.

FTD/SNAP

CSO: 1840/818

## IMMUNOLOGY

### ANTISTAPHYLOCOCCIC PLASMA AND GAMMA GLOBULIN DEVELOPED

Moscow VECHERNYAYA MOSKVA in Russian 9 Jul 84 p 2

[SAMOYLOV, B.]

[Excerpt] A medicine which is capable of conquering an invisible and treacherous foe--staphylococcic intoxication--is now in the hands of physicians.

Doctor of Medical Sciences T. V. Golosova, head of the bacteriology laboratory of the USSR Ministry of Health's Central Institute of Hematology and Blood Transfusion, related the following about this new method of treatment:

"In principle, the human body possesses a certain level of natural resistance to staphylococcic infection. Illness occurs as a result of a 'breakdown' or temporary lowering of immunity. A group of associates of our institute, one of whom was Doctor of Medical Sciences G. F. Papko, decided to develop an immune preparation against the treacherous microbe. We were joined somewhat later by a group of scientists from the Gor'kiy Institute of Epidemiology and Microbiology of the RSFSR Ministry of Health. This group was under the direction of I. N. Blokhina, member of the USSR Academy of Medical Sciences.

"It took two decades of tireless investigations to solve the problem. Stated in simplified form, the procedure for obtaining the new preparation is as follows. The staphylococcus secretes a poison--a toxin. This poison is extracted in pure form from a microbe culture and subjected to special processing. An anatoxin is obtained.

"This anatoxin is introduced into a donor without harm to the donor's health. The donor's organism reacts vigorously to the preparation and, in response to it, begins to produce protective, immune cells--antibodies (in this case, they are called antitoxins)--which are capable of rendering the poison harmless. Later, blood is taken from the donor, and the liquid part of this blood--the plasma, which contains the antitoxins--is separated. The remaining elements of the blood are returned to the donor. That is all. The medicine is ready.

"A method of obtaining dry antistaphylococcic plasma also has been developed at our institute," continued T. V. Golosova. "It has a number of advantages: it can be stored longer and is more convenient to transport. An antistaphylococcic gamma globulin also has been obtained."

A process for producing the preparation from blood which inevitably accumulates in certain kinds of medical interventions has been developed at the Gor'kiy institute. This has made it possible to increase the production of this medicine.

FTD/SNAP

CSO: 1840/1574

USSR STATE PRIZE NOMINATION FOR WORK ON ANTISTAPHYLOCOCCIC IMMUNE PREPARATIONS

Moscow MEDITSINSKAYA GAZETA in Russian 20 Jul 84 p 3

GAVRILOV, O., member of the USSR Academy of Medical Sciences

[Abstract] The author discusses the nature and significance of a work entitled "Development and Introduction into Broad Medical Practice of Antistaphylococcic Immune Preparations, and Scientific Substantiation of Immunotherapy of Staphylococcic Infections". This work, which has been nominated for the 1984 USSR State Prize, is said to present results of research and experiments carried out over the period 1964-1982 by scientists of the Central Scientific Research Institute of Hematology and Blood Transfusion of the USSR Ministry of Health and the Gor'kiy Scientific Research Institute of Epidemiology and Microbiology of the RSFSR Ministry of Health. Mention is made of some of the original preparations and methods for producing them which were developed in the course of the project, and a number of prominent scientists who took part in the project are identified.

FTD/SNAP

CSO: 1840/1573

UDC 543.544.42:547.458.68

NEW METHOD FOR ADDING LIGANDS TO POLYSACCHARIDES

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 20 Dec 83) pp 954-956

MOLOTKOVSKAYA, I. M., LYASHENKO, V. A. and MOLOTKOVSKIY, Yul. G\*., Institute of Immunology, USSR Ministry of Public Health, \*Institute of Bioorganic Chemistry imeni M. M. Shemyakin, USSR Academy of Sciences, Moscow

[Abstract] A new method for addition of ligand molecules to a polysaccharide matrix was developed. Polysaccharide (dextran) dissolved in dimethylsulfoxide is treated with  $\omega$ -cyanoalkaneacid chloride and pyridine, followed by catalytic hydrogenation. Thus-activated dextran is ready for addition of the desired ligand by commonly used methods. The number of C-atoms in the starting

cyanoacid determines the distance between the ligand and the matrix. Using this method, the preparation of fluorescein dextran was described. The advantage of this method is that the activation of the carrier and introduction of the chain extender is carried out concurrently, using easily available reagents. There are few if any impurities which could be easily removed during this process. References 10: 4 Russian (1 by Western author), 6 Western. [1569-7813]

#### USSR STATE PRIZE NOMINATION IN IMMUNOLOGY OF INFECTIOUS DISEASES

Moscow MEDITSINSKAYA GAZETA in Russian 3 Aug 84 p 3

DROZDOV, S., member, USSR Academy of Medical Sciences

[Abstract] The author comments on medical advances described in a work entitled "Research on the Immunology of Infectious Diseases and Its Use for the Improvement of Diagnosis and Treatment", which has been nominated for the USSR State Prize. This work presents results of a project carried out over a period of many years by a group of researchers from Moscow, Kiev and Alma-Ata. This group was headed by V. I. Pokrovskiy, member of the USSR Academy of Medical Sciences. The author relates that the group investigated principles governing the immune response in various infectious diseases and obtained fundamentally new data on relationships between recovery from these diseases and the correction of immunologic defects and arresting of immunopathologic processes occurring in the course of the diseases. Other original results of the project included proof that individual selection of the proper preparations is necessary for effective immunologic correction in specific infections, and development of practical methods for monitoring temporary immune deficiencies in infectious diseases.

FTD/SNAP  
CSO: 1840/819

#### ANTISTAPHYLOCOCCUS IMMUNE PREPARATIONS NOMINATED FOR USSR STATE PRIZE

Moscow MEDITSINSKAYA GAZETA in Russian 20 Jul 84 p 3

GAVRILOV, O., Member of the USSR Academy of Medical Sciences

[Abstract] The author discusses the nature and significance of a work entitled "Development and Introduction Into Broad Medical Practice of Antistaphylococcus Immune Preparations, and Scientific Substantiation of Immunotherapy of Staphylococcus Infections". This work, which has been nominated for the 1984 USSR State Prize, is said to present results of research and experiments carried out over the period 1964-1982 by scientists of the Central Scientific Research Institute of Hematology and Blood Transfusion of the USSR Ministry of Health and the Gor'kiy Scientific Research Institute of Epidemiology and Microbiology of the RSFSR Ministry of Health. Mention is made of some of the



original preparations and methods for producing them which were developed in the course of the project, and a number of prominent scientists who took part in the project are identified.

FTD/SNAP

CSO: 1840/785

UDC 577.352.465:57.085.23

MOLECULAR MECHANISMS OF LYMPHOCYTE ACTIVATION BY POLYIONS. PART 1.  
ALTERATIONS IN TRANSMEMBRANE TRANSPORT OF CATIONS

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 6, Jun 84  
(manuscript received 23 Jan 84) pp 599-604

PETROV, R. V., KHAITOV, R. M. and ATAULLAKHANOV, R. I., Institute of Immunology, USSR Ministry of Health, Moscow

[Abstract] In vitro studies were conducted on the mechanisms of lymphocyte activation by synthetic polyions, using (CBA x C57BL) $F_1$  mouse splenic lymphocytes. The stimulants used were poly-4-vinyl-N-ethylpyridium bromide (200 kdaltons) and polyacrylic acid (80 kdaltons). Introduction of the polyions into the lymphocyte suspension led to a rapid loss of  $K^+$  from the cells with an equally rapid influx of  $Ca^{++}$  from the medium into the cells. These effects, obtained with mitogenic concentrations of the polyions, were evident within seconds and were not inhibited by addition of ouabain (ATPase inhibitor), indicating that the polyions had no inhibitory effects on membrane transport enzymes. In fact, addition of either polyion was seen to enhance both  $Na^+, K^+$ -ATPase and  $Ca^{++}$ -ATPase. The proposed putative mechanism of action of these synthetic mitogens is believed to involve structural changes in the plasma membrane which increase permeability to cations. The increased cation fluxes along their concentration gradients appear to activate the respective ATPases, which fulfill the function of a compensatory mechanism. Figures 3; references 7 (Russian).  
[1566-12172]

## LASER EFFECTS

### LASER PUNCTURE THERAPY OF NERVOUS SYSTEM DISORDERS

Moscow MEDITSINSKAYA GAZETA in Russian 29 Aug 84 p 3

ANISHCHENKO, G., candidate of medical sciences and KOCHETKOV, V., doctor of medical sciences

[Abstract] The authors discuss experience with treatment of nervous system disorders at the Central Scientific Research Institute of Reflexotherapy by means of laser-puncture therapy. Commenting on the background of the selection of this type of treatment, they explain that once researchers determined the biological action of laser light on specific nerve receptors of the skin, development of laser apparatus capable of concentrating the beam in the millimeter band was undertaken. The devices that are being used for laser-puncture are said to operate in the red helium-neon band of light.

The authors identify beam parameters that have been selected for different groups of acupuncture points of the skin, and the courses of treatment (in seconds of radiation) and their time intervals. They go on to discuss the results of treatment of over 800 patients categorized in a group with disorders of the peripheral nervous system and a second group with disorders of the central nervous system.

FTD/SNAP  
CSO: 1840/819

UDC 577.391;591.481

### EFFECTS OF LASER IRRADIATION ON GLUTAMIC ACID METABOLISM AND KREBS CYCLE IN RAT BRAIN IN RELATION TO FUNCTIONAL STATUS OF ADRENORECEPTORS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 15 Jan 83) pp 29-34

PIKULEV, A. T., DZHUGURYAN, N. A., ZYRYANOVA, T. N., LAVROVA, V. M., MOSTOVNIKOV, V. A. and KHOKHLOV, I. V., Belorussian State University imeni V. I. Lenin

[Abstract] Outbred rats were used in a study designed to determine the effects of helium-neon laser irradiation of the head (632.8 nm, 25 mW/cm<sup>2</sup> for 15 min) on the status of glutamic acid metabolism and Krebs cycle function in the brain.

The laser irradiation parameters involved were seen to induce statistically significant changes in the activities of the following enzymes: succinate dehydrogenase (SDH)--enhanced activity, oxoglutarate dehydrogenase (ODH)--enhanced (insignificant), cytochrome oxidase (CO)--enhanced, NAD glutamate dehydrogenase (GDH)--enhanced, NADH GDH--depressed, cytoplasmic aspartate aminotransferase (AAT)--depressed, and mitochondrial AAT--enhanced. Administration of various agonists and antagonists of alpha- and beta-adrenoreceptors (epinephrine, norepinephrine, isoproterenol, propranolol, phentolamine) potentiated the effects obtained with laser treatment alone, regardless of whether the agents by themselves exerted positive or negative effects on the enzymes in question. It therefore appears that the effects due to the helium-neon laser of the intensity employed are mediated at least to some extent by adrenergic component of the sympathetic system. Figures 1; references 19: 10 Russian, 9 Western.  
[1545-12172]

MEDICAL AND ECOLOGICAL PROBLEMS OF AN AGROINDUSTRIAL COMPLEX

Kiev VRACHEBNOYE DELO in Russian No 7, Jul 84, pp 1-7

[Article by A. M. Serdyuk, Kiev]

[Text] The resolutions of the 26th CPSU Congress and May (1982) Plenum of the CPSU Central Committee clearly and thoroughly substantiated the present agrarian policy of the CPSU and economic and social aspects of the development of the agroindustrial complex, and approved the Food Program of the USSR. These far-reaching plans are based on the real potentialities of the socialist social structure and achievements of the scientific and technical progress. Their purpose is all possible intensification of agricultural production and creation of a highly developed agrarian sector of economy.

Attention of the party is directed toward the development of a huge production potential of the agroindustrial complex and adjacent sectors, improvement of management methods and maximum utilization of the available resources and potentialities. General Secretary of the CPSU Central Committee Comrade K. U. Chernenko stressed: "The party considers the concern for the development of agriculture not only as an economic problem, but also as a sociopolitical problem of paramount importance..."<sup>1</sup>. An effectively functioning agroindustrial complex becomes one of the determining items of further improvement of the material well-being of the Soviet people and strengthening of the might of our state.

In recent years, considerable progress has been made in the development of agriculture in the republic.

Firstly, the material and technical base of the agroindustrial complex has been strengthened. During three five-year plans, more than 60 billion rubles were spent on the development of this sector, or 3.6 times more than during the same preceding period. In 1984 alone, capital investments will reach six billion rubles. This will make it possible to form a diversified production system, provide more technical equipment for the farms, and increase the power-worker ratio.

At the present time, the capital and energy saturation of agriculture, areas of reclaimed lands and supplies of mineral fertilizers are three or four times higher

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1. Chernenko, K. U. Speeches at the All-Union Economic Conference on Problems of the Agroindustrial Complex. Pravda 27 Mar 1984.

than the 1965 level. In the Eleventh and Twelfth Five-Year Plans, capital investments in the republic's agriculture will amount to 55 billion rubles, and for the development of the entire agroindustrial complex -- about 69 billion rubles<sup>2</sup>.

Secondly, there is a transition to complex mechanization and automation and industrial methods of production. At the present time, practically all jobs on the cultivation and harvesting of cereals, sugar beets, potatoes and sunflowers are mechanized. Hundreds of large completely mechanized farms are functioning for the production of meat, milk, eggs and modern hothouse combines. Farms are being specialized and agroindustrial integration is developing.

New sectors have been created for serving the agroindustrial complex: machine-building for animal husbandry and feed production, rural construction, mixed food and microbiological industry. Agricultural machine building, production of mineral fertilizers, and chemical means for protecting plants against pests, diseases and weeds are developing further. Proper attention is being given to the problems of construction of new complexes of chemical protection and reconstruction of the existing ones.

Thirdly, the nature and conditions of labor are radically changing, and the number of high-speed and high-power machines is increasing. The pace of working processes and the nervous and emotional stress are increasing. The effectiveness of the functioning of the "man-machine" systems is increasing. In the last ten years, the number of machine operators increased by one and a half times, reaching 1.6 million people, and that of specialists increased threefold.

Scientific achievements and technical solutions are being introduced more and more widely into agricultural production. Special-purpose integrated scientific and technical programs "Agrokompleks" [Agrocomplex] and "Sakhar" [Sugar] and sectorial and regional programs developed in accordance with them are being effectively carried out. The realization of the tasks of the programs made it possible in three years to increase the scope of the use of industrial methods for cultivating the most important crops by four times<sup>3</sup>.

The republic has accumulated a wealth of experience in integrated solutions of the problem of development of modern rural areas. Party, Soviet and economic organizations have done extensive work on their social reorganization, improvement of public services and amenities and improvement of the material and living conditions of rural residents. As compared to 1965, average monthly wages of workers and employees of sovkhozes doubled, and wages of kolkhoz workers increased by 2.3 times. During three five-year plans, about 90 million square meters of residential housing, hospitals for 76,000 beds, more than 1,000 outpatient clinics and preschool children's establishments for 458,000 children were built in rural areas. On an example of any oblast and any rayon, it is possible to see the considerable changes that occurred in the nature and the content of labor and life of agricultural workers.

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2. Shcherbitskiy, V. V. "Scientific and Technical Progress is Party's Concern", Kiev, Politizdat of the Ukraine, 1983, pp 188-196.

3. Titarenko, A. A. "Effect of Concentration of Efforts", PRAVDA, 18 Jan 1984.

Care for the working and living conditions of rural workers and high standards in rural areas is in the center of attention of the Stryyskiy Rayon Party Committee of Lvov Oblast. For example, the central farm in Kolkhoz imeni Dzerzhinskiy is well organized. It has a spacious, well equipped outpatient clinic with a pharmacy. The village has water supply, gas and a sewage treatment plant. At the livestock breeding complex, the necessary microclimate is maintained by automatic devices, and there are a disease prevention clinic, a dental office and a sauna. Twice a year, just as at other farms of the rayon, physicians give preventive physical examinations to all workers. The kolkhoz allots tens of thousands of rubles every year for the prevention of diseases and maintenance of proper hygiene of labor and relaxation. All this, naturally, yields considerable results. The disease rate of the population decreased considerably, and their labor productivity increased. In Stryyskiy Rayon, the output of milk during the three years of this five-year plan increased by 18%, and that of meat by 29%. The problems of hygiene in rural areas and of health protection of their workers are being solved in an integrated manner in other rayons of Lvov Oblast, as well as at the farms of Vinnitsa, Ivano-Frankovsk, Kiev and Cherkassy oblasts.

The interrelations in the "agroindustrial complex-man" system are very complicated. According to G. I. Sidorenko, Academician of the USSR Academy of Medical Sciences, they are no less complicated than in the conditions of city agglomerations and have to be studied on the basis of the most modern hygienic approaches<sup>4</sup>. Industrialization of agriculture, development of new sectors of industry, and formation of large industrial associations and agrochemical complexes lead to radical changes in the production centers of rural areas and contribute to the intensification of anthropogenic effects on the environment and the health of the population.

In fact, the working conditions on many modern agricultural tractors and combines still do not fully meet the hygienic requirements. As a rule, vibration and noise on tractors and other self-propelled agricultural machines exceed permissible levels. During the period of main field jobs, on hot days, particularly in the southern rayons of the republic, the microclimate of the cabins changes sharply, and the temperature and air humidity vary within considerable limits. The air of the working zone is polluted by dust, exhaust gases, pesticides and mineral fertilizers. It is necessary to solve the problems of ergonomic and physiological designing of agricultural equipment.

Much attention must be given by hygienists to livestock breeding complexes which have various production factors and processes, operation lines and equipment requiring better scientific and technical solutions and hygienic justifications. Such complexes, particularly in the case of pastureless maintenance of animals, are sources of air contamination by ammonia, hydrogen sulphide, carbon monoxide and mercaptans used for protecting animals with various chemical substances whose content is found at distances of 3-5 km. Extensive use of biological

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4. Sidorenko, G. I. "The 'Environment-man' Problem in the Conditions of Agro-industrial Complexes", in the book "Mediko-sotsial'nyye aspekty Prodoval'stvennoy programmy SSSR v svete resheniy mayskogo (1982) i iyun'skogo (1983) Plenumov TsK KPSS" [Medicosocial Aspects of the Food Program of the USSR in the Light of the Resolutions of the May (1982) and June (1983) Plenums of the CPSU Central Committee], Moscow, 1983, pp 9-10.

preparations in livestock breeding, such as antibiotics, nutrient yeasts, amino acids, vitamins etc, changes the biological danger. Contamination of the environment by microbic and fungous flora and organic substances of animal origin increases.

It is urgently necessary to solve the problems of ecological expediency of the placement of livestock breeding complexes, provision of water resources for them, effective removal and utilization of wastes and manure-containing sewage water, toxicological evaluation of new pesticides and other chemical substances used in agriculture, prevention and elimination of contamination of the environment by factors of anthropogenic origin, nutritional hygiene, and populatization of the healthy way of life.

It should be stressed that scientific justification of complex problems of rural hygiene is treated in a considerable number of publications. It will suffice to say that the bibliographical index of Soviet and foreign literature for 1972-1982 published by Kiev Scientific Research Institute of Labor Hygiene and Occupational Diseases includes over 3600 titles. A considerable volume of studies has been carried out. At the same time, medical sciences must make a more considerable contribution to the realization of the Food Program. Specifically, this was pointed out at the All-Union Conference "Food Program and Complex Problems of Rural Hygiene" held in Kiev in March 1984.

Much work has been done in the republic on the All-Union problem "Scientific Principles of Rural Hygiene", particularly by the leading institute, Kiev Scientific Research Institute of Labor Hygiene and Occupational Diseases. The activities of twenty eight scientific institutions of the country are being coordinated. Creative contacts are strengthening with leading engineering groups engaged in the designing and modernization of agricultural equipment and the designing and construction of production, land-improvement and purification structures for rural areas.

The "Program of Complex Hygienic Studies to 1990 on Bettering Health Conditions of Labor and Life of the Rural Population" developed by a special committee with the purpose of substantiating medical aspects of the lowering of occupational and general disease rate of the rural population can be viewed as a constituent part of the Food Program and as a concrete direction of investigations on rural hygiene for the above period<sup>5</sup>.

A number of unsolved problems in the area of hygiene and labor protection were discussed for inclusion in joint research plans. Agreements were concluded for creative collaboration in conducting studies in the area of normalization of the organization of work places and factors of the production environment. This approach, undoubtedly, contributed to the acceleration of the introduction of scientifically substantiated hygienic recommendations and constructive proposals into the practice of agricultural production and, thus, to further improvement of the working conditions of agricultural workers.

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5. In the book "Mediko-sotsial'nyye aspekty Prodovol'stvennoy programmy SSSR v svete resheniy mayskogo (1982) i iyun'skogo (1983) Plenumov TsK KPSS", Moscow, 1983, p 5.



These problems are particularly urgent if we consider the special characteristics of the structure of rural population, its living conditions and its disease rate level. An important factor affecting the development of agricultural production is the unfavorable demographic situation in rural areas and the increasing shortage of manpower. In 1983, the natural increment of the population for the republic was 4.5; in cities it reached 6.9, while in rural areas it decreased to minus 0.1. In 1982, the number of workers in kolkhozes, sovkhoses and intermediate enterprises was less than in 1970, which was connected with a lack of housing and social and cultural facilities. Many rural populated centers still do not have paved roads leading to them, and only a negligible part of residential houses have running water, a sewage system and other types of public utilities. Some villages do not have bathhouses. This can hardly be explained by a high cost or "technical complexity" of a particular object. Evidently, this fact indicates also the attitude of local administrators toward living conditions of rural workers, the level of health education work and, to a certain degree, the high-mindedness of the sanitary and epidemiological service.

The intensification of agricultural production and the resulting complex of anthropogenic physical, chemical and biological factors of the environment can have a negative effect on the health of the population if they are in excess of hygienic regulations. Moreover, it is necessary to consider the specific characteristic of agricultural labor which is characterized by seasonal differences in physical loads, the way of life, living and nutritional conditions of rural population and differences in the climatic and geographical zones.

Naturally, in this connection it is particularly urgent to conduct epidemiological studies on the health of the rural population, and to study special characteristics of the propagation and progress of occupational, industrial, as well as general diseases and traumatism.

In this connection, the Kiev Scientific Research Institute of Labor Hygiene and Occupational Diseases obtained data on the state of health and disorders of specific functions in women working in livestock breeding and beet production. In a number of plant-growing sectors, manual and mechanized jobs were classified by the degrees of hardness, strenuousness and harmfulness. It is planned to develop such studies further with the use of unified methods of approach and inter-problem integration.

As a result of long-term studies conducted by VNIIGINTOKS in beet-raising regions of the Ukraine where pesticides are used widely, a high level of the cases of cardiovascular and nervous-system diseases was established among the rural population. In the same region, a higher rate of initial diseases of the nervous and endocrine systems, respiratory organs and digestive organs was observed among children. In the zones of intensive use of chemical means of plant protection, a tendency toward a higher disease rate was observed in occupational groups: among field crop growers, machine operators and livestock breeders.

The above data indicate the importance as well as the necessity of conducting such studies. There are problems whose solution would raise the level of studies. The expediency of creating an All-Union scientific center on complex problems of rural hygiene is being discussed. Studies on these problems are conducted by



many scientific institutions some of which are weak, not specialized and need constant scientific and methodological help. There is no doubt that the establishment of such a center would make it possible to concentrate scientific investigations and improve the quality of this work. This is convincingly confirmed by the experience in the operation of scientific centers on other most important sections of the medical science.

It is evident that it is necessary to improve the methodology of establishing the quantitative relation between the state of health of the population and the quality of the environment, to develop a system of the most informative health criteria and to determine real and maximum permissible loads of the effects of the entire variety of the environmental factors on the human organism with consideration of the age, sex and social characteristics. Naturally, this presupposes further development of the statewide system for monitoring the quality of the environment and the population's health and integration of hygienic knowledge. There is no doubt that such an approach will make it possible to predict the public health level, make corrections in health measures and to implement concrete measures for the preservation and strengthening of health of the Soviet people.

Demographic changes which are occurring in rural areas, aging of the population, shortage of labor resources and the lowering of the public health potential make it necessary to revise the tactics of the medical support of the rural population. This is particularly important because the existing differences in the disease rate levels of urban and rural population for the main classes of pathology indicate that less medical care is provided for rural residents, particularly outpatient and polyclinical care. This has a negative effect on the main parameters of the treatment and diagnostic processes (timely and complete examination, efficiency of treatment) and on the determination of the prevalence of diseases.

For example, the hospitalization rate per 100 urban and rural residents in 1983 was, respectively, 25.4 and 25.9, i.e., the disease rate level was approximately identical according to the hospitalization data. In reality, these figures are different. The total disease rate per 1000 people reached 1250 for urban areas, and it was only 450 for rural areas. In cases of mass diseases, such as acute respiratory viral infections and influenza, the rate of visits to physicians in rural areas is one fifth of that in urban areas, and there are five times more complications resulting in pneumonia and chronic lung diseases.

There is a similar situation with the detection of tuberculosis cases, malignant tumors and other diseases which often lead to a temporary or stable disability. In rural areas, persons suffering from chronic, sometimes irreversible, forms of pathology constitute a considerable part among persons with diseases of blood-circulation, respiratory and digestive organs and malignant tumors.

There is a noticeable gap between steady improvement of labor conditions and the absence of a corresponding decrease in labor losses due to illness. In other words, in spite of the positive dynamics in the working and living conditions of workers and 2.5 billion rubles spent by the republic on measures for the improvement of labor conditions and labor protection in this five-year plan, there is an inadequately slow decrease in the cases of illnesses with temporary disability.

One of the reasons is improper attitude of workers and members of kolkhozes to the hygienic and safety requirements. Many occupational diseases in industry and agriculture still occur due to an inadequate level of sanitary and technical standards of the workers. Each second eye injury occurs because workers and kolkhoz members do not use protective eyeglasses which are available in sufficient quantities. It is necessary to use all forms of influence on this important part of joint work of health agencies and industrial and agricultural groups. Reserves for lowering the existing level of temporary disability should be sought both in public health services and in the organization of medical care.

It is appropriate to give the example of public health services of Ivano-Frankovsk Oblast. There occurred substantial changes in recent years in the organization of hospital and outpatient care to rural population. In 1983, the average capacity of TsRB [central rayon hospitals] reached 385 beds, physicians in 18-22 specialties work in polyclinics, departments of functional diagnostics, clinical diagnostic laboratories, physiotherapeutic and other departments have been created. There are 78 medical ambulatories functioning in the oblast, and a rural medical section serves 4000 to 6000 people. At the beginning of the Ninth Five-Year Plan, there were 3.6 visits to physicians per one rural resident, and five visits during the Tenth Five-Year Plan, while in 1983 there were 8.4 visits. This made it possible to lower considerably the level of labor losses among agricultural workers.

The necessity of raising the level of medical services to rural population is obvious. In the light of the requirements of the May (1982) Plenum of the CPSU Central Committee, the UkSSR Ministry of Health developed concrete measures directed toward the maintenance and strengthening of the health of the workers in agricultural production. It is true that these measures are not being implemented successfully everywhere, and the main reason is the absence of a business-like approach to the solution of problems and insufficiently efficient control over the results of the measures. In the light of the requirements of the June (1983) Plenum of the CPSU Central Committee about the introduction of general prophylactic medical examination of the population, this work should be conducted more intensively and purposefully.

During the forthcoming period, attention should be focused on a considerable intensification of the preventive trend in public health, reorganization of the activities of medical institutions, all possible strengthening of outpatient polyclinic services and providing more medical personnel for their primary sections. In three years, 4500 young specialists were assigned to work in district hospitals and ambulatories, however, their number is still insufficient in many medical institutions. For example, in Kharkov Oblast, 64 positions of pediatricians and seven of dentists are still vacant, in Sumy Oblast, respectively, 53 and 23, in Odessa Oblast -- 38 and 5, etc. Naturally, this does not help bringing aid to rural population and to raising its level. In Dnepropetrovsk, Nikolayev and Poltava Oblasts, many midwifery centers (FAP) do not have paramedical workers. Few typical FAP buildings are being built. In Ternopol and Transcarpathian Oblasts, only each fourth FAP is housed in such buildings, and in Odessa Oblast -- each third. It is a standard practice to house FAP in one rented room. These and other problems are a substantial obstacle in the intensification of work in providing prophylactic medical examinations to the population.

The front of agricultural work is expanding every day. The efforts of the public health agencies and institutions must be directed toward raising the level of medical services to rural workers, introduction of new advanced forms of the organization of medical aid and advanced experience and toward ensuring healthy and safe working conditions. A decisive change is necessary in solving urgent medical and ecological problems of modern rural areas and agroindustrial complexes in order to move ahead from the already obtained truths, expanding our theoretical horizon and expanding our notions about the most important regularities of the economic, sociopolitical and spiritual progress of our country<sup>6</sup>.

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10,233

CSO: 1840/1094

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6. Comrade K. U. Chernenko's speech at the June (1983) Plenum of the CPSU Central Committee, PRAVDA, 15 Jun 1983.

COURSE ON MEDICAL SUPPORT OF DEEP-WATER AND DIVING WORK

Leningrad VECHERNIY LENINGRAD in Russian 26 May 84 p 1

KUZNETSOV, A.

[Text] Medical personnel undergoing training at the Institute for Advanced Training of Physicians imeni Kirov have passed 'diving' examinations. They are leaving our city today.

"For the first time here, specialists have been trained in a course on medical support of deep-water and diving work," said V. P. Kozlov, chief diving specialist of the RSFSR Ministry of the River Fleet's Administration for Underwater Technical and Construction Work. "Physicians from eight cities took the course. These specialists have acquired practical skills in addition to special medical knowledge. Each of them made seven dives with an overall time under water in excess of 40 hours. The training of diver-physicians is necessitated by the growing volume of underwater work in our country."

FTD/SNAP

CSO: 1840/1574

# MINIATURE ELECTROANALGESIA APPARATUS 'CHENS'

Moscow VECHERNYAYA MOSKVA in Russian 30 Jul 84 p 2

SAMOYLO, B.

[Excerpt] I recently visited the Central Scientific Research Institute of Reflexotherapy, where an unusual apparatus has undergone clinical tests. It soothes pain with the aid of electricity.

"It is the 'CHENS', a new, miniature electrical analgetic apparatus," Professor Stepan Mikhaylovich Zol'nikov, deputy director of this institute, explained to me. "Its intriguing name is simply an acronym of 'percutaneous electroneurostimulator'."

This apparatus' plastic body closely resembles that of an electric shaver. It fits comfortably into one's hand. However, the "CHENS" has a number of metal electrodes in the place where the cutters of a shaver would be located. The lever of a regulator is located on a side surface of the apparatus.

The "CHENS" runs on a 9-volt "Krona" battery. The instrument was developed jointly by an enterprise of the Ministry of the Electrical Equipment Industry and specialists of the institute.

The "CHENS" is simple to use. The patient independently selects a mode of action and massages the injured section of his body with a circular motion. Each of the instrument's electrodes emits 10 pulses a second, which act on neurons (nerve cells) and ease pain.

"In what kinds of cases is the apparatus effective?" the professor was asked.

"It has a wide range of application," said S. M. Zol'nikov. "The 'CHENS' has performed well in relieving pain following various surgical interventions, as well as so-called chronic pain."

FTD/SNAP

CSO: 1840/819

## AORTIC VALVE MECHANISM LEADS TO BETTER PROSTHESIS

Moscow TRUD in Russian 10 Aug 84 p 4

POMINOV, A.

[Abstract] The article provides background on a discovery which has been registered in the field of cardiology. It was made by scientists and engineers of the All-Union Surgery Research Center of the USSR Academy of Medical Sciences, and the Moscow Higher Technical School imeni Bauman (MVTU).

A conversation with Candidate of Medical Sciences Sergey Leonidovich Dzemeshkevich, senior science associate of the surgery research center and one of the authors of the discovery, is recorded. The discovery is said to be a result of studies of the operating mechanism of the aortic valve which Dzemeshkevich and his colleagues conducted with the aim of designing optimal biological prostheses for the replacement of damaged valves. Dzemeshkevich related that Doctor of Technical Sciences V. Sagelevich and Candidate of Technical Sciences N. Zavalishin of MVTU were enlisted in this project when an unusual structure of the root of the aorta and the aortic valve was discovered. Further investigations revealed, in particular, that the cusps of the aortic valve are set in motion by changes in the effort and movements of the elastic framework of the aorta's root, which is connected with these cusps. An investigation of the possibility of artificially reconstructing this framework was begun as a result of the discovery.

This research reportedly made possible the development of a new type of biological prosthesis which is free of danger of blood clots or other anomalies. An artificial aortic valve of this type which was implanted in a patient six years ago by Professor Boris Alekseyevich Konstantinov, another of the discovery's authors, is still performing excellently, according to Dzemeshkevich.

FTD/SNAP  
CSO: 1840/819

## NEW DEVELOPMENTS IN BLOOD SUBSTITUTES

Moscow TRUD in Russian 10 Jul 84 p 3

KLYUCHEROV, G., correspondent (L'vov)

[Abstract] The article is an interview with Professor Nikolav Mikhaylovich Turkevich of the L'vov Medical Institute's chair of pharmaceutical chemistry, regarding features of blood substitutes which have been developed at this institute.

Turkevich comments on progress in improving the properties of perfluoro-compound blood substitutes in particular. His group has developed a blood substitute which is described as a white emulsion containing iron and oxygen in a bound state, in addition to carbon and fluorine. This preparation has a shelf life of up to one year at room temperature, and it can be used at any time. It prevents cardiac arrest in patients who have lost 80 percent of their blood, or even 100 percent in clinical conditions, it is claimed. The new blood substitute is being tested in animals, and it is to be clinically tested in humans in approximately a year.

Turkevich showed the author of this article a powder from which another blood substitute is prepared. It is a chelate compound obtained from globin protein and porphyrins. When the powder is chemically combined with the white emulsion, a mixture is obtained which is said to carry oxygen as well as natural blood.

Turkevich mentioned in conclusion that his group is now working on such problems as the development of blood substitutes that are soluble in water, and of perfluorocompounds for prolonging the storage time of donor organs intended for transplantation.

FTD/SNAP

CSO: 1840/1573

UDC 615.371/.372+576.8

## DEVELOPMENT OF VACCINE AND SERUM RESEARCH IN UZBEKISTAN IN PAST 60 YEARS

Tashkent MEDITSINSKIY ZHURNAL UZBEKISTANA in Russian No 5, May 84  
(manuscript received 29 Dec 83) pp 16-20

VAFAKULOV, B. Kh., MIRISMAILOV, A. I. and BABAKHODZHAYEV, N. K., Tashkent Scientific Research Institute for Vaccines and Serums

[Abstract] This is a survey of the history of the work of the Tashkent institute since its beginnings during the Bolshevik revolution, when it effectively initiated work in microbiology in the region, to the present time. Its laboratories developed essential bacteriological preparations, chiefly vaccines against smallpox, first produced using a lymph strain from Moscow but soon with local strains. Visceral Leishmania became a special study of the institute in 1927; the disease has now been eradicated. Public health and hygiene also received major emphasis in its work. Serum production and methods

for producing polyvalent anti-gangrene and anti-tetanus serums were also developed, along with various multiple vaccines. So-called "Q"-fever was identified and an antigen developed in 1951. Antigens to protect livestock as well as humans have been developed in recent years, along with new methods of purification and advanced mass production techniques. The Tashkent institute has also initiated branch institutes that have become independent research institutes over the years, as Uzbek Republic institutes and in Samarkand. International ties and attendance at meetings in the USSR and abroad are also summarized. Current research includes search for remedies for dysentery and quality improvements for serum and vaccines produced at the institute.

[1092-12131]

UDC 616.341-008.913:613.632-009

#### FEATURES OF INTESTINAL DIGESTION IN CHRONIC POISONING BY HEXACHLOROCYCLOHEXANE

Tashkent MEDITSINSKIY ZHURNAL UZBEKISTANA in Russian No 5, May 84  
(manuscript received 18 Feb 83) pp 47-49

ZAKIROV, U. B. (professor), KADYROV, U. Z., VOLOKHVYANSKIY, Ye. A. and MIRTURSUNOVA, S. Z., Department of Pharmacology, Tashkent Order of Labor's Red Banner Medical Institute

[Abstract] Hexachlorocyclohexane pesticides have wide application, and thus they have become subjects of research. Following previous research on HCCH effects on pancreatic and intestinal enzymes, the authors here report on chronic effects of a 1/50 dose of LD<sub>50</sub> HCCH administered over 180 days to white rats. After 15, 30, 60, 120 and 180 days 8 subjects were analyzed for pancreatic enzymes and the small intestines dissected and analyzed. Results indicated that activity of glycyl-valinedipeptide hydrolase (GVPH) began to increase at the 15th day, with specific volume rising by 39% and summary volume by 73%. By the end of the tests depeptide hydrolase activity had fallen by some 18%. Invertase also grew in activity in the first month, then fell by the end of 2 months. The same pattern was observed for other enzymes of the intestines. Thus measures for preventing pesticide intoxication must include feed programs using functional characteristics of the intestinal tract by emphasizing readily digested proteins and avoiding fats and disaccharides. References 8 (Russian).

[1092-12131]



## EFFECT OF HEXACHLORANE ON PHAGOCYTIC ACTIVITIES OF NEUTROPHILS

Tashkent MEDITSINSKIY ZHURNAL UZBEKISTANA in Russian No 5, May 84 pp 49-51

KHAMIDOV, M. Kh. and MUKHTAROVA, M. I., Department of Obstetrics and Gynecology of the Pediatric Faculty and Central Scientific Research Laboratory of the Samarkand Order of the Friendship of Peoples Medical Institute

[Abstract] Recent research has shown that many organic chloride pesticides that accumulate in the soil end up in animals and humans. The present article reports on the effect of chronic intoxication of this type on immunity factors studied in female chincilla rabbits which received 1 mg/kg of body weight of hexachlorane for 12 months. Results showed that while the phagocytic index in control rabbits was  $58.8 \pm 2.3\%$ , and the phagocytic quality  $1.63 \pm 0.03$ , it fell markedly for the test animals, showing a steady decline over the entire test period. For pregnant rabbits in particular, immunity declined significantly, even though the course of pregnancy did not show specific anomalies. [1092-12131]

UDC 612.34-099-092.9

## OXIDATIVE PHOSPHORYLATION AND POLY-ENZYME SYSTEM OF MITOCHONDRIAL MEMBRANES OF PANCREAS UNDER EFFECTS OF HEXACHLOROCYCLOHEXANE

Tashkent MEDITSINSKIY ZHURNAL UZBEKISTANA in Russian No 5, May 84  
(manuscript received 1 Apr 83) pp 51-55

GULYAMOV, T. D., candidate of medical sciences and ALMATOV, K. T., candidate of biological sciences, Scientific Research Institute for Reginal Medicine, UzSSR Ministry of Health

[Abstract] Chlorohexane pesticides used in agriculture, particularly on cotton plantations, affect sub-cellular and mitochondrial structures, but no studies have been published on their effect on the pancreas. The present article reports on study of HCCH effects on male white rats given the pesticide for 15 and 60 days in cottonseed oil, at  $1/20$  LD<sub>50</sub>, and  $1/3$  LD<sub>50</sub> on one occasion. Mitochondrial respiration in various metabolic states were registered polarographically. Results indicated that the  $1/3$  dose showed statistically inconclusive reduction of succinate oxidation, while oxidative phosphorylation of the pancreatic mitochondria also changed insignificantly. Changes in membrane permeability were also inconclusive. More significant was the change in structural coupling between individual links of the respiratory chain, followed by failure of the entire chain, including the relatively resistant S-oxidase cytochrome. References 7: 4 Russian, 3 Western. [1092-12131]

## STATE OF REGIONAL BRAIN CIRCULATION IN PERSONS SUFFERING CEREBRAL VASCULAR PATHOLOGY WORKING IN CONDITIONS OF VIBRATION

Tashkent MEDITSINSKIY ZHURNAL UZBEKISTANA in Russian No 5, May 84  
(manuscript received 10 May 83) pp 55-57

ASADULLAYEV, M. M., candidate of medical sciences, Scientific Research Institute of Sanitation, Hygiene and Occupational Illnesses, Ministry of Health, UzSSR

[Abstract] The clinical picture and diagnosis of cerebral vascular pathology induced by vibration has received little attention. The present article reports on such pathology in persons showing deficiencies in cerebral blood supply, discussing arterial factors such as the systolic and diastolic blood pressure, the catacrotic index and anacrotic index. Excavator operators, drilling machine operators and other operators of heavy equipment in an age range of 30-49 were examined. Lipid metabolism of victims of arteriosclerosis showed high cholesterol and lipoproteid contents compared to the control group. Those suffering hypertension had pulsing, diffuse headaches. Small doses of nitroglycerine relieved many of the symptoms. Rheoencephalogram study did not show particular variations between the control group or the test group, with moderate changes found in those with atherosclerosis of cerebral blood vessels, and more pronounced deterioration in those with hypertensive disease. Thus, those with occupationally-induced illnesses of these types could be treated successfully with nitroglycerine, neck manipulations and pressure on the carotid arteries.

[1092-12131]

UDC 618.3-099.092.9+618.29-099-092.9

## EFFECT OF TECHNICAL HEXACHLORANE ON PREGNANCY AND PHYSICAL DEVELOPMENT OF THREE GENERATIONS

Tashkent MEDITSINSKIY ZHURNAL UZBEKISTANA in Russian No 5, May 84  
(manuscript received 23 Jul 83) pp 57-60

KHAMIDOV, M. Kh., Department of Obstetrics and Gynecology, Samarkand Order of Friendship of Peoples Medical Institute

[Abstract] Numerous recent studies of organic chloride pesticides used in agriculture have shown their persistence in soil, animals and humans. The current article reports on the effect of allowable residual concentrations (PRC) of hexachlorane (at 1 mg/kg of body weight) on chincilla rabbits. Parameters analyzed included fertility, course of pregnancy and the physical development of offspring. Results showed that conception was somewhat lower in the test group. The offspring of those receiving the pesticide also had less body weight and length. There were some stillbirths (none occurred in the control group) and more later mortality of young rabbits. By the third generation, the test group offspring were "catching up" in body weight by two months of age. The need for controlling pesticide intoxication and other prophylactic measures is suggested. References 7 (Russian).

[1092-12131]

UDC 547.485.3'913.3'118.057

SYNTHESIS OF MORAPRENYLPYROPHOSPHATEOLIGOSACCHARIDES--POSSIBLE INTERMEDIATE PRODUCTS IN BIOSYNTHESIS OF O-SPECIFIC POLYSACCHARIDES FROM E. COLI 08 AND 09

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 15 Nov 83) pp 946-953

TORGOV, V. I., SHIBAYEV, V. N., KOCHETKOV, N. K., Institute of Organic Chemistry imeni N. D. Zelinskiy, USSR Academy of Sciences, Moscow

[Abstract] The goal of the present study was to synthesize moraprenylpyrophosphateoligosaccharides, derivatives of four isomeric  $\alpha$ -D-mannopyranosyl-D-glucopyranoses. The first stage of this work was aimed at synthesizing disaccharides Man $\alpha$ 1 $\rightarrow$ 2Glc, Man $\alpha$ 1 $\rightarrow$ 3Glc, Man $\alpha$ 1 $\rightarrow$ 4Glc, Man $\alpha$ 1 $\rightarrow$ 6Glc and their complete acetates. Detailed synthetic routes for each of the above compounds were reported, all reactions being based on procedures reported in literature. Using the MacDonald procedure, the above acetates were converted to phosphates, saponified with LiOH and purified by ion exchange chromatography to yield  $\alpha$ -glycosylphosphates. The latter were reacted with moraprenylphosphoimidazolidine to yield moraprenylpyrophosphateoligosaccharides (20-35%) which could be used as precursors in the biosynthesis of O-specific polysaccharides E. coli 08 and 09. The final products were stable on storage in methanol solution containing ammonium acetate. References 25: 7 Russian, 18 Western (2 by Russian authors). [1569-7813]

# NONIONIZING ELECTROMAGNETIC RADIATION EFFECTS

UDC 577.39/539.104.539.12

## EFFECT OF DECIMETER ELECTROMAGNETIC RADIATION ON MYOCARDIAL CELL MEMBRANES

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 15 Nov 82) pp 276-279

ZUBKOVA, S. M. and LAPRUN, I. B. Central Scientific Research Institute of Health Resort Science and Physiotherapy, USSR Ministry of Health, Moscow

[Abstract] Electromagnetic fields were studied in murine myocardial cell membranes in order to determine their effect on peroxidation and  $\text{Ca}^{2+}$  binding in the membrane surface layers. Membranes were subjected to the effects of electromagnetic radiation at a frequency of 0.5 GHz. A description is given of the equipment specially developed to generate this field. Experimental findings indicated that decimeter-range irradiation caused changes in lipid peroxidation and the ability of the myocardial membrane to bind  $\text{Ca}^{2+}$ . The presence of p-chloromercuriobenzoate in the membrane decreases or nullifies the changes observed. The previous presence of p-chloromercuriobenzoate followed by decimeter-range irradiation results in normalization of lipid peroxidation intensity, possibly indicating conformation restructuring of premembrane layers in the myocardial cells, altering access for the p-chloromercuriobenzoate to the sulphhydryl groups. Under the conditions it is possible that the glycocalix and lipid component are optimally conditioned for the functioning of the labile fraction of the  $\text{Ca}^{2+}$  bound to these structures. It is suggested that decimeter-range electromagnetic radiation may affect myocardial contractile function. Figures 1; references 10: 4 Russian, 6 Western.  
[1546-9642]

## PHARMACOLOGY AND TOXICOLOGY

### NEUROPEPTIDE PREPARATIONS

Riga SOVETSKAYA LATVIYA in Russian 25 Jul 84 p 4

ANDREOTTI, Yu.

[Abstract] The article records comments of Doctor of Medical Sciences Roman Kruglikov, head of a laboratory of the USSR Academy of Medical Sciences' Institute of Higher Nervous Activity and Neurophysiology, regarding the properties of original and effective medicinal preparations which have been developed in the USSR on the basis of research of neuropeptides. Mention is made, in particular, of the neuropeptide preparations "vasopressin" and "dilargin". Vasopressin, which has already been introduced into practice, is said to strengthen conditioned reflexes that have been developed. It has been used successfully in long-term treatment of alcoholism. Dilargin reportedly has passed experimental clinical tests at the All-Union Cardiology Research Center. It is said to be effective against a number of stomach disorders.

FTD/SNAP

CSO: 1840/785

### PRODUCTION AND PHARMACEUTICAL USES OF SNAKE VENOM

Ashkhabad TURKMENSKAYA ISKRA in Russian 31 Aug 84 p 4

BAYBORODINA, D.

[Abstract] The article is an interview with Aleksandr Sergeyevich Tarabrin, head of the Kalinin Serpentarium, which is an enterprise of the Turkmen SSR Ministry of Forestry. Tarabrin provides some information on the production of snake venom for medical purposes at this and other organizations.

Tarabrin mentions that the serpentarium has five employees. It produces about 300 grams of dried venom in the course of a gathering season, which lasts 6-7 months. By comparison, Tarabrin says, the Baku Herpetology Laboratory produces 4,000 to 5,000 grams. He estimates the total annual production of dried snake venom in the USSR to be about 10,000 grams. The Tallin Chemical-Pharmaceutical Plant is the chief consumer of the Kalinin Serpentarium's product, and this year new ties were established with the Omutinsk plant in Kirov Oblast.

Tarabrin explains that snake venom is a raw material for a number of anesthetic and hemostatic drugs and medicines for the treatment of asthma, hypertension and other conditions. The patent medicines "Vipratoks", "Virpralgin" and "Viprosal" contain snake venom, for example.

A photograph of A. S. Tarabrin is given.

FTD/SNAP  
CSO: 1840/819

UDC 547.455.623'363.057

#### SYNTHESIS OF ALKYLGLUCOSIDES WITH CONJUGATED DOUBLE BOND SYSTEM

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 2 Dec 83) pp 957-962

RUSANOVA, Ye. Ye., VOLKOVA, L. V., YEVSTIGNEYEVA, R. P., Moscow Institute of Fine Chemical Technology imeni M. V. Lomonosov

[Abstract] Due to their amphiphilic properties, synthetic and natural glycolipids are capable of forming vesicles which are not very stable, however. Recently, liposomes were obtained from lipids capable of polymerization and cell recognition. The goal of this study therefore was to synthesize stereochemically model glycolipids with conjugated double bond system at the terminal point of the alkadiene chain: 11,13-tetradecadien-1-yl- $\beta$ -D-glucopyranoside and 11,13-pentadecadien-1-yl- $\beta$ -D-glucopyranoside. These molecules contain a carbohydrate "marker" modelling cell recognition process. References 11: 1 Russian, 10 Western.  
[1569-7813]

#### ANTI-STENOCARDIA NITROGLYCERIN DRUG 'TRINITROLONG'

Moscow MEDITSINSKAYA GAZETA in Russian 18 Jul 84 p 3

METELITSA, V., professor, head of the department of preventive pharmacology of the Institute of Preventive Cardiology of the USSR Academy of Medical Sciences' All-Union Cardiology Research Center

[Abstract] The author provides information on an original drug called trinitrolong. It is a prolonged-action nitroglycerin preparation which is said to arrest attacks of stenocardia. Flakes of it adhere to the gum under the upper lip, and it enters the circulatory system steadily and over a long period of time through the mucous membrane of the oral cavity, bypassing the liver. The preparation also prevents stenocardia attacks during the period of its resolution. This preventive effect lasts for three to five hours. The author recommends that trinitrolong be prescribed only before the onset of physical or emotional stresses which give rise to stenocardia attacks.

The author relates that trinitrolong was developed by the All-Union Cardiology Research Center and the All-Union Medical Technology Scientific Research and Testing Institute of the USSR Ministry of Health. Its production was authorized in 1980, and a modern shop for producing it was set up quickly at the "Sanitas" plant. Although the drug could have appeared in pharmacies as early as 1981, its mass production is being delayed by a lack of facilities for the production of the copolymer vinylpyrrolidone and of ethyl acrylate and acrylamide, according to the author.

FTD/SNAP

CSO: 1840/1573

UDC 577.175.853'17:547.964.4.057

#### BIOLOGICALLY ACTIVE LOOP-SHAPED ANALOGUES OF BRADYKININ AND POLYSTESKININ

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 14 Nov 83, after revision 9 Jan 84) pp 891-901

MUTULE, I. E., MUTULIS, F. K., LANDO, O. Ye., ASHMANIS, A. A., GRIGOR'YEVA, V. D., MYSHLYAKOVA, N. V., KLUSHA, V. Ye. and CHIPENS, G. I., Institute of Organic Synthesis, LaSSR Academy of Sciences, Riga

[Abstract] Continuing the studies of structure-function relationship of peptides, loop-shaped analogues of bradykinin and polysteskinin were synthesized by classical methods of peptide chemistry. The structures of these peptides are: X-cyclo[Lys-Pro-Pro-Gly-Phe-Gly-Pro-Phe-Arg] where X = Lys-Lys-Lys (I) or Lys-Lys-Lys-Leu-Arg-Gly (II). These products were obtained by attaching the linear "tail" fragments to partially deblocked cyclopeptide, removing the protective groups and purifying the end product by reverse phase and ion exchange chromatography. The biological testing consisted of in vivo assays of arterial pressure of anesthetized rats and in vitro (rat's uterus) evaluation of their myotrophic activity. Both analogues affected the arterial pressure of test animals, showing prolonged hypotensive activity. Both compounds also exhibited slight myotrophic activity in the in vitro assay. The similarity in biological effects of loop-shaped and cyclic analogues of bradykinine led to an assumption that their mechanism of action is similar. Figures 5; references 25: 10 Russian, 15 Western (7 by Russian authors).  
[1569-7813]

## NMR STUDY OF SPACIAL STRUCTURE OF 3 NAJA NAJA SIAMENSIS TOXIN

Moscow BIOORGANICHESKAYA KHIMIYA in Russian Vol 10, No 7, Jul 84  
(manuscript received 22 Dec 83) pp 869-890

KONDAKOV, V. I., ARSEN'YEV, A. S., UTKIN, Yu. N., KARLSSON, Ye., GUREVICH, A. Z., TSETLIN, V. I., BYSTROV, V. F. and IVANOV, V. T., Institute of Bioorganic Chemistry imeni M. M. Shenyakin, USSR Academy of Sciences, Moscow; Institute of Biochemistry, Uppsala, Sweden

[Abstract] The present work was devoted to NMR study of conformational characteristics of the long chain neurotoxins 3 *Naja naja siamensis* (S-T3) in solution. To help assign the signals in  $^1\text{H}$ -NMR spectra, a series of its mono-acetyl derivatives was also used and a close homologue, the toxin 3 *Naja naja naja* (N-T3). Most of the signals from aromatic and aliphatic regions were assigned. The microenvironment of selected functionally important radicals was elucidated. A region was identified in which the neurotoxin molecule was affected by conformational transition induced by protonation of His<sup>22</sup> and accompanied an altered accessibility of the imidazole ring to the solvent molecules. According to EPR data, the S-T3 derivative with spin labels at Lys<sup>27</sup> and Lys<sup>53</sup> showed an increased inter-label distance from 18 Å to 23 Å when the pH was changed from 7.5 to 3.5. Overall, the spacial structure of the S-T3 neurotoxin molecule in solution agrees basically with the structure determined by x-ray structure analysis of the crystalline material. The local conformational transition of physiological pH values may be related to the specific kinetics of binding long neurotoxins to acetylcholine receptor in contrast to short neurotoxins which showed no such transition. Figures 14; references 39: 4 Russian, 35 Western (8 by Russian authors).  
[1569-7813]

UDC 547.898

## BIOLOGICAL ACTIVITY OF MACROHETEROCYCLIC COMPOUNDS. PART 1. BIOACTIVITY OF CRYPTATE [2,2,2]

Moscow BIOLOGICHESKIYE MEMBRANY in Russian Vol 1, No 7, Jul 84  
(manuscript received 18 Nov 83) pp 677-683

BOGATSKIY, A. V. (deceased), LUK'YANENKO, N. G., NAZAROV, Ye. I., TSYMBAL, I.P., OLESHKO, A. Ya., IONTOV, I. A., ZAKHARIYA, A. N., NAZAROV\*, V. M., FRONTAS'YEVA\*, M. V. and PERESEDOV\*, V. F., Physicochemical Institute, Ukrainian SSR Academy of Sciences, Odessa; \*Joint Institute of Nuclear Research, Dubna

[Abstract] The macrodentate compound 4,7,13,16,21,24-hexaoxa-1,10-diazobicyclo [8,8,8]hexacosane (cryptate[2,2,2]) was tested for its effectiveness in the elimination of Zn from outbred mice and transplanted tumors, and for its mechanism of toxicity. Administration of cryptate[2,2,2] intraperitoneally in



a dose of 15 mg/kg for 4 days, beginning 6 days after subcutaneous transplantation of Sarcoma 45, resulted in the elimination of Zn from the liver and the tumor, but had no effect on the renal levels of Zn. Toxicity studies on the outbred mice yielded an LD<sub>50</sub> value of 64.5 mg/kg. Studies on the effects of cryptate[2,2,2] on cecum smooth muscle cells, intestines, and hepatic mitochondria indicated that the mechanism of action responsible for toxicity consisted of enhanced permeability to Ca<sup>++</sup> and uncoupling of oxidative phosphorylation. The latter mechanism appeared to involve a pH-dependent increase in intramitochondrial membranes to K<sup>+</sup> with consequent disruption of mitochondrial function. Figures 6; references 17: 1 Ukrainian, 7 Russian, 9 Western.  
[1567-12172]

## PHYSIOLOGY

### SURVIVAL STUDIES DURING 500-KILOMETER DESERT HIKE

Moscow NEDEL'YA in Russian No 30, 23-29 Jul 84 pp 4-5

GRECHANIN, V.

[Abstract] The expedition "Man and the Desert" is on its way from Alma-Ata to the starting point of a 500-kilometer hike across the Karakumy Desert. The members of this expedition have completed a five-year training program and walked for many hundreds of kilometers through the Taukumy, Sarykumy and Kyzylkumy deserts. Nikolay Nikolayevich Kondratenko, an instructor of the Kazakh Institute of Physical Culture and head of the expedition, was interviewed by "Nedelya" before the hike.

"Extreme situations in which, for various reasons, man is left to face the desert alone are inevitable. What can he count on, what are his organism's potentialities and how to utilize them skillfully, in order to remain safe and sound? Our main task is to study these questions as fully as possible and complete our journey safely."

"What is the scientific significance of your march?"

"The membership of the organizations which took part in the preparation and support of the expedition alone will enable you to judge its significance. Among them are the Institute of Medical Biological Problems of the USSR Ministry of Health or, to be more specific, Doctor of Medical Sciences Vitaliy Georgiyevich Volovich, one of this institute's leading specialists, who is our chief consultant; our own Institute of Physical Culture; the Kazakh Academy of Sciences' Institute of Geography; the Turkmen Academy of Sciences' Institute of Physiology and Experimental Pathology of the Arid Zone; and the Kazakh affiliate of the Institute of Nutrition. The expedition's research program includes study of the cardiovascular and respiratory systems, bodily water and salt metabolism and features of diet, an array of medical and biological observations, and meteorological and geographic studies."

"And is all of this to be done by the eight members of the expedition?"

"They are the primary team. There are also five back-up people who have undergone training in line with the same program and are ready to take the place of any member of the primary team. Along our route are three meteorological stations, where we expect to meet briefly with specialists of the institutes I mentioned. These specialists will make necessary observations of our condition.

"The entire 500-kilometer route--from the Tashkui Well in Tashauz Oblast to Bakharden settlement west of Ashkhabad--must be traversed by August 6. Marches covering 22-25 kilometers each will be made only by night. During the daytime, we shall rest under a special tent with room for eight persons. Plans call for one period of radio communication a day with the expedition's headquarters in Ashkhabad.

"Each member of the expedition will carry on his back a load equal to approximately half his own weight."

"I don't see you wearing any special clothing. Won't it be needed in the desert?"

"No, it won't. The only thing we borrowed from outside are felt hats of the kind metalworkers wear."

FTD/SNAP

CSO: 1840/785

PUBLIC HEALTH

MEDICAL INFRARED AND MICROWAVE IMAGING CENTER IN GOR'KIY

Moscow MEDITSINSKAYA GAZETA in Russian 25 Jul 84 p 4

AFANAS'YEV, A.

[Text] A scientific research and clinical diagnostic infrared and microwave imaging center has opened in the city of Gor'kiy, attached to facilities of the Scientific Research Institute of Traumatology and Orthopedics and the USSR Academy of Sciences' Institute of Applied Physics.

A human being presents a rather unusual appearance to physicists, biologists and physicians in this center's laboratories. He is viewed as a small radio set which emits invisible flows of heat waves. Unique instruments developed by Gor'kiy radio astronomers have turned their antennas from cold heavenly bodies to the warmth and illnesses of man.

"The scientific and technical revolution has made possible the development and advancement of fundamentally new methods for diagnosing various illnesses and traumas," said Professor L. B. Likhтерman, one of the center's scientific directors. "Television can also be included among these methods."

The first experiments carried out at the USSR Academy of Sciences' Institute of Applied Physics, the Radiophysics Scientific Research Institute and other Gor'kiy institutions have demonstrated that it is possible to obtain useful information by probing with microwaves and SHF. For the first time, the registration of human heat radiation over a wide range--from infrared rays to millimeter and centimeter radio waves--is being utilized for medical diagnostic purposes at the center.

The center's personnel have big plans. They include conducting an examination of workers for the purpose of early detection of occupational pathology, as well as quick diagnosis of traumatic, vascular and oncologic disorders. Specialized-topic training programs and advanced training of physicians in infrared imaging have been organized at the center's facilities.

FTD/SNAP  
CSO: 1840/784

# COMPUTERIZED PATIENT-MONITORING SYSTEM NOMINATED FOR USSR STATE PRIZE

Moscow IZVESTIYA in Russian 26 Jun 84 p 3

BURAKOVSKIY, V., member of the USSR Academy of Medical Sciences

[Abstract] The author comments on the computerization of heart patient monitoring at the USSR Academy of Medical Sciences' Institute of Cardiovascular Surgery imeni Bakulev. The work, entitled "A New Approach to the Diagnosis and Treatment of Acute Circulatory Disorders Using Mathematical Models and Methods, and Introduction of this Approach", has been nominated for the USSR State Prize.

Major contributors to the work are identified. Doctor of Biological Sciences, Professor V. Lishchuk, head of the surgery institute's laboratory of mathematical modeling of biological systems, directed the development of mathematical models which reflect complex processes taking place in patients. An information-and-control system was developed for continuous postoperative monitoring of the condition of patients who had undergone complex heart surgery. Software for this system and programs for physician-computer dialog were developed under the direction of engineer Yu. Ganichkin, head of a hardware and software group. Also taking an active part in the development and introduction of the new monitoring methods were a group of the institute's physicians and the clinical group of the institute's mathematical-modeling laboratory. These groups were headed by Candidates of Medical Sciences I. Storozhenko and V. Podgornyy, respectively.

The monitoring system is said to be based on a third-generation computer programmed with a mathematical model of blood circulation and heart contractions. Physicians can prepare individualized mathematical models for ascertaining more precisely the causes of pathological changes in a patient's condition.

FTD/SNAP

CSO: 1840/784

UDC 577.391:547.963.3

RADIATION IMPAIRMENT OF RNA METABOLISM IN INTERPHASE DEATH OF LYMPHOID CELLS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 7 Apr 83) pp 147-153

ZHIVOTOVSKIY, B. D. and KHANSON, K. P. Central Scientific Research Institute  
of Roentgenology and Radiology, USSR Ministry of Health, Leningrad

[Abstract] The role of postradiation impairment of RNA metabolism in activating and realizing interphase death of lymphoid cells is reviewed. The role of primary damage to the DNA molecule in transcription is considered. The presence of structural defects in the DNA molecule can lead during the first minutes of irradiation either to increased transcription activity or to disruption of matrix properties. The lifetime of various RNA lymphocyte populations subjected to the effects of radiation is discussed. Biosynthesis and maturation of ribosomal RNA are considered. Postradiation impairment of RNA synthesis and processing occurs in a staged manner, first involving specific impairment of RNA processing within the nucleus, and then nonspecific degradation of the ribosomal RNA fractions and the sequences in heterogenous nucleic RNA that are not part of messenger RNA and fulfill regulatory functions within the nucleus. The ways in which impairment of the transcription process can be reflected in the death of lymphoid cells is discussed. A general scheme is suggested for the mechanism of cell death following irradiation, in which the RNA participates. The effector agent (a hormone, alkylating substance or radiation) reacts with a receptor (in the case of a hormone this is a protein, in the case of radiation it may be the RNA), which in turn reacts with sensor genes and activates the transcription process. Transcription products cause a series of metabolic shifts characterized by impairment of energy metabolism and other changes that finally result in cell death. Figures 1; references 33: 14 Russian, 19 Western.  
[1546-9642]

## MODIFYING ACTION OF PROFOUND HYPOXIA ON EFFECTS ON NEUTRON IRRADIATION IN MICE

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 10 Feb 83) pp 190-194

KALMYKOVA, G. I., TIMOSHENKO, S. I. and SVERDLOVA, A. G., Leningrad Institute of Nuclear Physics imeni B. P. Konstantinov, USSR Academy of Sciences, Gatchina

[Abstract] Although considerable research has been conducted on the modifying effects of hypoxia on the biological action of neutrons, only isolated cells have been studied. Little information is available on the oxygen effect in neutron irradiation of cells in critical systems, and almost no data exist on the effect of hypoxia on neutron damage to the entire body in mammals. In this work an attempt was made to clarify the degree of the oxygen effect in hypoxia in deeply hypoxic irradiated mice. Experimental animals were irradiated in a mixed gamma-neutron field with neutrons at a mean energy of 0.85 MeV and making up 85% of total radiation, to give a dose of 0.25 Gy/min. Thirty-day survivability following neutron irradiation improved substantially in hypoxic animals: a dose of 8.0 Gy led to the death of all control animals while those in an anoxic state showed more than 90% survival at doses of 4.0 to 12.0 Gy. Ten percent of mice even survived following doses of 19.6 Gy.  $LD_{50/30}$  was  $6.1 \pm 0.8$  Gy for controls and  $15.2 \pm 1.9$  Gy for experimental animals in X-ray irradiation. Lack of oxygen also affected the aftereffects resulting from X-ray irradiation at doses above 5 Gy. Deep hypoxia also exerted a beneficial effect on the condition of the small intestine in the early postradiation period, and on active restorative processes in the later postradiation period. The hematopoietic apparatus was less affected in hypoxic animals. Figures 3; references 9: 6 Russian, 3 Western.  
[1546-9642]

UDC 577.391.612.01.017.1

## RESTORATION OF CELLULAR IMMUNE SYSTEM FOLLOWING SUBLETHAL IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 15 Nov 82) pp 195-198

KIRILLOVA, Ye. N., Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] A study was made of the qualitative and quantitative characteristics of cell populations participating in the immune response during a period of 1 month following sublethal irradiation in doses inducing maximum oncologic effect in CBA mice. Irradiation was done using the experimental EGO-2 gamma installation. One day after irradiation the cell count in the bone marrow had fallen to 25% of its baseline value, but had returned to normal levels by day 30. Depopulation of the thymus was even greater, falling to one-tenth of baseline value after 1 day and returning to 69% of normal after 14 days. Cell

counts in the spleen and lymph nodes fell less dramatically but were only 70% of normal after 30 days. At 2 weeks following irradiation the leukocyte count was 40-50% of normal and at 3 weeks was almost normal, but subsequently fell again to 65% of normal at 30 days. Colony-forming units in the spleen and bone marrow were most reduced in the immediate postradiation period. Spleen colonies were restored by day 21, but again declined by day 30. In general, colony-forming units were not restored by day 30 in the bone marrow, and repopulation of the peripheral lymphoid organs was not complete at 30 days. Plaque-forming cells were restored to 41% of baseline values after 14 days, and the same level was seen also at 30 days. These lower values were the result of T-cell and B-cell and predecessor depopulation; the functional activity of these cells was also lowered. At all stages of the observation the ability of the T-suppressors was lowered following irradiation, Killer cell activity was lowered. Thus, radiation doses of 3 Gy in mice resulted in marked depopulation of the lymphoid organs, with restoration in the central organs taking place more rapidly and more completely than in the peripheral organs. No close correlation was found between complete restoration of quantitative indexes for lymphatic tissue and its functional capacity. Figures 3; references 12: 2 Russian, 10 Western.  
[1546-9642]

UDC 677.391.47:612.014.481.1

#### ROLE OF CERULOPLASMIN IN RESISTANCE TO X-RAY IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 25 Feb 83) pp 199-203

BERDINSKIKH, N. K., ANTONENKO, S. G., VOLOSHCHENKO, Yu. V., CHEBOTAREV, Ye.Ye., and GAVRISH, I. N., Institute of Problems of Oncology imeni R. Ye. Kavetskiy, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] Since one of the effects of radiation is to impair physiological processes associated with copper and iron metabolism and the formation and accumulation of free radicals and peroxides resulting in complex changes in the body, it is suggested that exogenous ceruloplasmin might exert an antioxidant effect in these circumstances. To test this hypothesis human and murine ceruloplasmin preparations were administered to experimental animals 1 hour before or after irradiation with a sublethal or lethal dose ( $LD_{40}$  5.28 Gy,  $LD_{100}$  7.2 Gy) of X-rays delivered at a dose rate of 0.55 Gy/min. It was found that the hemoglobin content in the blood of experimental animals was higher than in controls at 1 and 5 days following irradiation, with virtually no difference in the red cell count in the two groups. The reticulocyte count fell at 1 and 5 days in both experimental animals and controls. The lymphocyte count in experimental animals at 1 and 5 days was higher than for controls. In the early postradiation period the administration of ceruloplasmin resulted in greater seizure of peroxide radicals in the blood serum, and the ceruloplasmin acted as an inhibitor of lipid autooxidation and increased copper transport



and iron utilization. Indices for bone marrow cells were also improved, with the numbers of immature cells greater than in controls. Thirty-day survival following the sublethal dose of radiation was 100% in animals receiving ceruloplasmin (10 mg/kg or 20 mg/kg) 1 hour before or after irradiation. Survivability in the control group was 60%. Some 17% percent of treated animals survived longer than 30 days following the lethal radiation dose. Figures 2; references 9: 6 Russian, 3 Western.  
[1546-9642]

UDC 577.391.612.015.33.611.438

STUDY OF MOLECULAR MECHANISMS IN RADIATION DEATH OF LYMPHOID CELLS. CHROMATIN DEGRADATION AND DNA REPLICATION IN FRACTIONS OF IRRADIATED THYMOCYTES

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 20 Jan 83) pp 208-210

SOROKINA, N. I., FILIPPOVICH, I. V. and ROMANTSEV, Ye. F., Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] The hypothesis that the process of renewed DNA replication in irradiated thymocytes is involved in the yield of polydeoxyribonucleotides (I) and cell death was tested experimentally in mice using the EGO-2 installation to deliver 2.5 Gy of 60 Co gamma rays. The findings showed that large and small thymocyte fractions were the same in terms of lag period for yields of (I). Amounts, however, differed and matched cell radiosensitivity. Thus, the amount of (I) formed after irradiation of thymocytes can serve as an index for radiosensitivity. If chromatin degradation starts simultaneously in both fractions and the incision stage alters with time, then the suggestion that replication is involved in chromatin degradation in irradiated thymocytes is not confirmed. The effects of radiation on the initiation stage are discussed. A small block of replication was seen immediately following irradiation in the large thymocyte fraction. In the small thymocyte fraction, which is more radiosensitive, 1 hour after irradiation this process was observed to be taking place more actively. The findings indicate either that similar initiation of replication after irradiation also takes place in the small fraction but is masked or, more likely, that initiation of DNA replication in the irradiated small thymocyte fraction is not suppressed. It is suggested that a similar picture may be found in the radiosensitive and radioresistant fractions of the T-lymphocytes. Figures 2; references 11: 5 Russian, 6 Western.  
[1546-9642]

## EFFECT OF VARIOUS AMINOALKYLENEPHOSPHONIC COMPOUNDS ON BUILDUP OF RADIOACTIVE BERYLLIUM IN RATS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 4 Apr 83) pp 223-227

RAZUMOVSKIY, N. O., YELATONTSEVA, N. B. and RUDOMINO, M. V., Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] A study was made of various aminoalkylenephosphonic compounds (aminoisopropylidenephosphonic acid (AIP), ethylenediamino-N,N-bismethylene-phosphonic acid (EDBP), ethylenediamino-N,N'-bismethylenephosphonic acid (EDDP), N,N'-dimethylethylenediamino-N,N'-bismethylenephosphonic acid (EDMP), ethylenediamino-N,N'-bisisopropylidenephosphonic acid (EDDIP, fosfitsin), ethylenediamino-N,N'-bisethylenephosphonic acid (EDEP), nitrolotrimethylene-phosphonic acid (NTP), N-(2-oxyethyl)ethylenediamino-N,N',N'-trimethylene-phosphonic acid (OEDTP), 2,3-dioxybutane-1,4-diamino-N,N,N',N'-tetramethylene-phosphonic acid (BATP), diethylenetriaminepentamethylphosphonic acid (DTPP), and EDDIP + DTPP) in order to provide a basis for further research on the effect of these compounds in accelerating radioactive beryllium clearance. Experiments were conducted in 100 male rats after administration of beryllium-7 as the chloride. All tested compounds were to some degree or other effective in accelerating radioactive beryllium clearance. The greatest effect was found when DTPP and EDDIP were used in combination. In this case, buildup of beryllium-7 was reduced up to 12% in the bones and 7% in the liver, and a marked decrease in buildup was noted in the lungs (up to 28%), spleen (up to 15%) and kidneys (up to 11%). References 11 (Russian)  
[1546-9642]

UDC 577.963.3:577.391

## STUDY OF CHROMATIN BREAKDOWN IN MURINE PERIPHERAL LEUKOCYTES IN FIRST THREE DAYS FOLLOWING COMBINED RADIATION INJURY

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 13 Sep 82) pp 210-213

PECHENINA, N. A., RYABCHENKO, N. I. and BRITUN, A. I., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] Since the accumulation of polydeoxyribonucleotides (I) in the lymphoid cells following irradiation can serve as criterion for the severity of radiation damage, a study was made of chromatin breakdown in the peripheral leukocytes in rats subjected to combined radiation and burn injuries in order to determine the degree of information that can be derived from such a criterion. A "Luch" installation was used to deliver gamma doses of 3.0, 7.5 and 9.0 Gy, followed 1 hour later by experimental burns covering an area

10 x 12 cm on the back. Yields of (I) in the peripheral leukocytes in rats differed as a function of time since injury and whether or not the radiation damage was "pure" or combined. Following "pure" or combined radiation injury, (I) levels in the thymus increased in the first 4 hours following injury and then fell slightly over the next 3 days. Maximum values for yield of (I), characterizing the level of white cell chromatin breakdown, were seen on day 3 following irradiation. Since in both types of injury profound lymphocytopenia was observed during the initial postradiation period (up to 3 days), it is suggested that the marked increase in the levels of (I) (4 to 6 times higher than in controls) in the leukocytes is associated with chromatin breakdown in the nuclei of the granulocytes rather than with postradiation chromatin breakdown in blood lymphocytes. As the radiation level was increased, yield of (I) increased. Increased burn area did not, however, exert any significant effect on levels of (I). Figures 1; references 8: 6 Russian, 2 Western.  
[1546-9642]

UDC 577.391

EFFECT OF THYROXINE AT  $G_0$  STAGE IN CELL CYCLE ON DEGREE OF CHROMOSOME  
ABERRATION IN MURINE HEPATOCYTES AND HUMAN LYMPHOCYTES FOLLOWING X-IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 10 Mar 82) pp 233-236

ANTIPENKO, Ye. N., TIMCHENKO, O. I., VOLKOVA, T. M. and FEDOROVA, A. A.,  
Kiev Scientific Research Institute of General and Communal Hygiene  
imeni A. N. Marzayev

[Abstract] The involvement of thyroxine ( $T_4$ ) in cell repair was investigated in order to clarify the ability of  $T_4$  to affect chromosome repair processes, determine when in the cell cycle this effect takes place, and discover whether or not the modifying effect of  $T_4$  is the result of direct reaction between the hormone and the cell. Experimental studies were conducted on the hepatocytes of X-irradiated male rats (2.19 Gy), and chromosome integrity was also studied in vitro in irradiated human peripheral lymphocytes (1.31 and 2.19 Gy). The experimental protocol accounted for any elimination of cells with aberrant chromosomes or slow mitosis of such cells. It was found that  $T_4$  influenced the number of chromosome aberrations by restoring chromosome integrity. This was seen in the absence of any modifying effect from  $T_4$  when it was administered following neutron irradiation, that is, in conditions that substantially reduce the degree of repair. It was also shown that  $T_4$  acted in the  $G_0$  phase of mitosis in murine hepatocytes. The behavior of  $T_4$  in irradiated and non-irradiated human lymphocytes showed that its modifying effect resulted from direct hormone-cell reaction. It is concluded that  $T_4$  can be regarded as a stimulus for repair capacities retained in the cell following irradiation, and that it acts in the  $G_0$  phase of the cell cycle. References 15: 9 Russian, 6 Western.  
[1546-9642]

## WAYS TO USE RADIOMODIFYING EFFECT OF SEROTONIN ON CELLS IN HEMATOPOIETIC SYSTEM

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 1 Feb 83) pp 236-240

SMIRNOVA, I. B., DONTSOVA, G. V., KONSTANTINOVA, M. M. and RAKHMANINA, O. N.,  
Institute of Developmental Biology imeni N. K. Kol'tsov, USSR Academy of  
Sciences, Moscow

[Abstract] Experiments were conducted in mice to study the effect of serotonin as a radioprotective agent in irradiation at doses large enough to affect the hematopoietic system. The study was done in order to clarify whether or not serotonin also acts in other cell populations and if so how, and whether serotonin's radioprotective effect depends on whether it is administered before or after irradiation. Experimental subjects received a radiation dose of 3.5 or 7 Gy and serotonin was administered 15 minutes before or immediately after irradiation (0.5 or 2.0 mg serotonin per mouse). The effect of the serotonin was determined from the yield of spleen colony-forming units and the bone marrow karyocyte count. Preradiation administration of serotonin resulted in a marked increase in the growth rate of hematopoietic cells after irradiation, with more rapid (compared to controls) restoration of normal spleen weight. Post-radiation administration of serotonin did not affect spleen weight or the number of colony-forming units, but bone marrow cells were restored much more rapidly than in unprotected subjects. Thus, serotonin's radioprotective properties are seen in increased numbers of viable cells if administered before irradiation, and in intensification of cell proliferation when administered following irradiation. The therapeutic effect takes place through the action of serotonin directly in the cell, seen both in vivo and in vitro. The effects take place through a hypoxic mechanism, which is discussed. References 10: 8 Russian, 2 Western.  
[1546-9642]

## GAMMA SENSITIVITY IN INTERGENERIC CONJUGANTS OF VIBRIO CHOLERAE BIOTYPE PROTEUS x SERRATIA MARCESCENS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 10 Mar 83) pp 246-249

SOKUROVA, Ye. N. and GOLOVINA, V. S., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] Results are presented from experiments to study gamma sensitivity in 33 clones of intergeneric conjugants, with complete survivability curves, and 64 clones with determination of radiosensitivity and survival following a single dose or radiation. Bacterial cultures of *Vibrio cholerae* biotype *Proteus* and *Serratia marcescens* (recipient) were studied after gamma irradiation at a dose rate of 0.103 Gy/sec. Survivability was determined from the

ability of cells to form colonies. The 33 intergeneric conjugants were found to fall into one of four different categories in terms of radiosensitivity: those similar to the donor cells (2 clones), those having radioresistance intermediate between donor and recipient (2 clones), those identical with the recipient cells (18 clones), and those characterized by radioresistance somewhat greater than the recipient (11 clones). Thus, most conjugants were either the same as the recipient cells or slightly more radioresistant to gamma radiation. Another group (64 clones) irradiated with a dose of 115 Gy displayed basically the same spread of radiosensitivity. The findings in the main agree with earlier studies indicating that acquisition of plasmid factors by bacterial cells leads to enhanced UV-resistance and resistance to ionizing radiation. References 12: 5 Russian, 7 Western.  
[1546-9642]

UDC 577.391:577.7

AGE-RELATED CHANGES IN RADIOSENSITIVITY IN ANIMALS AND CRITICAL CELL SYSTEMS.  
SURVIVABILITY OF STEM CELLS IN SMALL INTESTINE EPITHELIUM AND 4-5 DAY DEATH  
RATE IN MICE OF VARIOUS AGES FOLLOWING IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 20 Apr 83) pp 249-252

KONOPLYANNIKOVA, O. A. and KONOPLYANNIKOVA, A. G., Scientific Research  
Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] The severity of radiation injuries to the epithelium of the small intestine largely determines survival rate in associated stem cells. However, in light of the paucity of data on age-related changes in the radiosensitivity of animals in terms of "intestinal" death and injury to the stem cells of the small intestine epithelium, a comparative study was made of age-related changes in death rate in three strains of mice (albino, CBA and C57Bl/6, male and female) using the "intestinal" criteria, and of small intestine epithelial stem cell survival. It was found that radiosensitivity was higher in juvenile and aged mice, comparable to age-related changes found in the bone marrow cells. Changes in survival rates for animals of different ages in all three strains were of the same general character but values for  $LD_{50/4}$  differed considerably. Radiosensitivity of stem cells, as characterized by the values for  $D_0$ , showed little age-related change in all three strains. No direct correlation was found between the effect of radiation and cell levels. It was concluded that for prolonged periods in life about the same number of stem cells retain their proliferative ability in the intestinal form of radiation injuries, with this ability decreasing only in aged animals. Figures 1; references 12: 10 Russian, 2 Western.  
[1546-9642]

## IMPROVING EFFECTIVENESS OF IRRADIATION FOR LEWIS' CARCINOMA IN MICE WITH ADETURON

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 20 Oct 83) pp 258-261

MIRCHEVA, Y. Y., Scientific Institute of Oncology, Medical Academy, Sofia

[Abstract] A study was made of the effect of adeturon (S-2-aminoethylisothiuronium) on the radio response of Lewis carcinoma in mice. After transplanting the carcinoma intramuscularly in the thigh in a  $2 \cdot 10^6$  suspension of cancer cells, treatment was initiated 7 days later when the tumor size had grown to 7-9 mm. A single dose of 250 mg/kg adeturon was administered 30 minutes before irradiation of the tumor. Tumors were irradiated in a GUT-200 installation using a 60-Co source at a dose rate of 1.88 Gy/min at SSD 24 cm and again thrice at 7, 9 and 11 days following tumor implantation. In a first experimental series fractionated dose was 15 Gy, in a second, 20 Gy. Therapeutic effectiveness was assessed from tumor size, time taken for tumor size to double, mean survival time of subjects and value for a coefficient of retardation. Administration of adeturon without irradiation was ineffective. Irradiation alone at the dose rates indicated (3 x 15 Gy) slowed tumor growth 68.8% and no further growth was seen during the period of observation following the course of radiation. Radiation (3 x 15 Gy) plus adeturon markedly retarded tumor growth starting with the first radiation session, and by the end of the period of observation tumor growth had been retarded 71.5 percent. Size taken for tumor size to double was 119 hours in controls, 295 hours in irradiated subjects, and 361 hours in radiation-plus-adeturon subjects. Increasing the radiation dose to 60 Gy (3 x 20 Gy) resulted in greater retardation of tumor growth followed by tumor shrinkage back to its initial size. It was concluded that adeturon strengthened the antineoplastic action of the radiation and may be promising in radiotherapy for malignant neoplasms. References 12: 8 Russian, 4 Western.  
[1546-9642]

UDC 577.391;612.273

## RADIOPROTECTIVE EFFECTIVENESS OF GGS-10 HYPOXIC GAS MIXTURE IN EXPERIMENTS IN DOGS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 29 Mar 83) pp 264-266

STRELKOV, R. B., CHIZHOV, A. Ya., KUCHERENKO, N. G., ZHAVORONKOV, L. P., SKLOBOVSKAYA, I. E., TSYGANKOVA, V. A., LEPEKHIN, V. P. and RONIN, M. Ya., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] In an attempt to clarify conflicting earlier findings on the radioprotective properties of the hypoxic gas mixture GGS-10 (10% oxygen, 90% nitrogen) a study was made of its effect in various whole-body doses.

Experiments were conducted in 128 dogs of both sexes irradiated in a GUB-20000 60-Co gamma installation to give whole-body doses of 2.8, 3.5, 4.2 and 8.0 Gy delivered at 0.7-0.5 Gy/min. GGS-10 was administered with the aid of a mask starting 5 minutes before and irradiation and throughout the entire period of irradiation. The 45-day survival rate and the picture of the peripheral blood at days 3, 7, 14, 21 and 28 following irradiation were used to evaluate the radioprotective properties of GGS-10. It was found that GGS-10 lowered subcutaneous tissue  $PO_2$  from  $33.6 \pm 0.7$  to  $16.2 \pm 1.2$  mm/hg 5 minutes after the start of inhalation. Similar changes in the tissue of the small intestine and bone marrow were also found in experimental animals. Administration of GGS-10 was associated with increased survival rate following irradiation at 2.8 Gy (83.3% of controls died within 45 days, 31.8% of experimental animals). At 3.5 and 4.2 Gy no statistically confident difference was found between controls and experimental subjects. The 8.0 Gy dose was absolutely lethal for both controls and experimental subjects, but the latter survived longer. Blood analysis showed a less marked drop in white cell formed elements in GGS-10-protected subjects. Figures 1; references 4 (Russian) [1546-9642]

UDC 577.391:616-001.28

#### PARAMETRIC ANALYSIS OF PERIODS OF DEATH IN IRRADIATED ANIMALS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84  
(manuscript received 1 Mar 83) pp 267-269

KADYROVA, N. O. and PAVLOVA, L. V., Central Scientific Research Institute of Roentgenology and Radiology, USSR Ministry of Health, Leningrad

[Abstract] A new approach is suggested for calculating survival rate in irradiated animals. The method is based on a theoretical substantiation of distribution employed from the standpoint of a model that describes the mechanism through which the random value for T, used to express life expectancy following acute irradiation, is found. In order to make this approach, in addition to a mathematical model of the processes of radiation injury and postradiation recovery it is also necessary to be able to draw an analytical conclusion for the distribution law operating within the framework of such a model. It is assumed that the processes of injury and recovery occur in time in a staged manner, and accordingly each stage represents a certain condition that characterizes the degree of injury in a subject. The mathematical apparatus is shown and used to calculate survival rate for a typical sample. Evaluation of unknown distribution parameters can be done using the probability method. Examples are shown. Use of the proposed method extends opportunities for statistical analysis of survival rate in irradiated animals by enabling interpretation of appropriate data in terms of intensity, injury and recovery. It is also possible to assess the numbers of animals dying from various radiation syndromes. References 8: 4 Russian, 4 Western. [1546-9642]



REVIEW OF BOOK 'RADIOPROTECTIVE EFFECTS IN ANIMALS AND MAN' BY V. G. VLADIMIROV  
AND G. K. DZHARAK'YAN

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84 p 282

KUDRYASHOV, Yu. B., reviewer

[Abstract] The book deals with theoretical and experimental aspects of ways and methods used in chemical protection against ionizing radiation. Principles are shown for calculating indexes that reflect the intensity of basic metabolic processes and dose rates for pharmacological agents that have been tested in animals. The importance of selecting the correct experimental animals to test cystamine and other sulfur-based drugs is discussed. Criteria for evaluating the severity of radiation injuries are examined, including leukocyte UV-fluorescence and the redox potential in muscle tissue, together with cytologic methods, including cell status, radiation blocking of proliferation, interphase death, radiosensitive cells, colony formation, bone marrow cell activity and bone marrow chromosome aberration. The book is criticized for being too concise in some areas, in particular in dealing with new data on metabolic pathways for sulfur-containing protective agents leading to the formation of 2-amino-2-thiazoline. The authors' ideas on prospects for the use of deoxynucleoside urea and beta-aminoisobutyric acid expression to assess the severity of radiation injuries in animals and man seem somewhat outdated. The authors give almost no space to the question of using the mediative action of protective agents through the release of endogenous sulfhydryl groups and biogenic amines. In general the book represents an important attempt to make a systematic approach to the problem of chemical means of radiation protection. No references.

[1546-9642]

UDC 577.391

REVIEW OF BOOK 'RADIOTOXINS' BY A. M. KUZIN AND V. A. KOPYLOV

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 2, Mar-Apr 84 pp 283-284

BARABOY, V. A., reviewer

[Abstract] This book offers a complete description of the history and present-day status of the radiotoxin problem. The analysis of all aspects of the problem reveals its weak and strong points and the book may be considered a solid scientific work for applied areas of biology, medicine, agriculture, biotechnology and the food industry. The history of radiotoxins is traced back to the work of F. Ellinger (1935-1939) and his "histamine" theory. The problem of humoral products responsible for a number of radiobiological effects is discussed. The link between radiotoxins and the problem of natural radiation protection is examined, but insufficient space is devoted to this subject. The question of the involvement of radiotoxin-mediated effects as part of total radiation effect in tissues raises difficult methodological problems. The superadditive effect from the combined action of radiation and radiotoxins



evidently suggests that the range of compounds designated as radiotoxins should be enlarged. Special note is made of the authors' own personal contribution to experimental and theoretical work on the problem of radiotoxins in plant and animal biology. The metabolic action of the radiotoxins is discussed. It is considered that this book represents an important contribution to the development of Soviet radiobiology and will be popular among both specialists and junior scientists. No references.  
[1546-9642]

UDC 577.391;577.158

FREE RADICAL CHANGES IN MOUSE TISSUES AFTER IN VITRO EXPOSURE TO  $\gamma$ - AND NEUTRON IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 16 Nov 82) pp 3-8

SVISTUNENKO, D. A., RIKHIREVA, G. T., PULATOVA, M. K. and YERMAKOV, V. M.,  
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Energy imeni I. V. Kurchatov, Moscow

[Abstract] ESR spectroscopy was used to follow perturbations in hepatic and splenic free radicals of outbred mice subjected to 190-760 Gy  $\gamma$ - or 190-790 Gy neutron irradiation. Both forms of radiation were seen to damage the basic cellular components such as DNA, lipids, proteins, and water molecules, yielding a linear dose-response dependence of the ESR signal for all free radicals. T<sup>H</sup>-type radicals were recorded only from the spleen, and the yield of  $\cdot R_s$  radicals obtained from the irradiated spleens was much higher than from the irradiated hepatic tissues. These observations suggest that  $RO\cdot(\cdot R_s)$ -type radicals are formed by disruption of the sugar-phosphate bonds in DNA, with the formation of such free radicals being greater with the fission neutrons than with  $\gamma$ - irradiation. Analysis of the RBE ( $G^n/G^Y$ ) showed that both types of radiation damaged DNA to an equal extent. However, the much higher RBE values for K<sup>•</sup> and Q<sup>•</sup> radicals indicate that the fission neutrons were more damaging for the cellular lipid components than  $\gamma$ -rays. Figures 3; references 10:  
6 Russian, 4 Western.  
[1545-12172]

## EFFECTS OF SECONDARY RADIATION OF 70 GeV PROTONS ON MAMMALIAN CELL DNA

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 15 Nov 82) pp 9-12

LEONT'YEVA, G. A., FOMENKO, B. S., ANTIPOV, A. V. and MANTSYGIN, Yu. A.,  
Institute of Biological Physics, USSR Academy of Sciences, Pushchino

[Abstract] Monolayer cultures of Chinese hamster fibroblasts and Burkitt's lymphoma cells were subjected to irradiation with secondary 70 GeV protons (2.5-20 Gy) to evaluate their effects on mammalian DNA. Evaluation of the data on single-strand breaks in DNA showed that the RBE was 1.7-7.6 for the fibroblasts and 1.04-3.8 for the lymphoid cells. The degree of repair following damage with the protons and  $\gamma$ -irradiation (2.5-20 Gy) was essentially identical in both cases. A noteworthy fact is that the relationship between the RBE and the proton dose was an inverse one. Figures 3; references 14: 6 Russian, 8 Western.  
[1545-12172]

## EFFECTS OF ULTRASHORT, POWERFUL UV PULSES ON REPLICATION AND TRANSCRIPTION OF DNA IN PROLIFERATING AND RESTING HeLa CELLS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 27 Dec 82) pp 17-20

KARU, T. Y., KALENDO, G. S. and LETOKHOV, V. S., Center for Technological Lasers, USSR Academy of Sciences (AS), Troitsk; All-Union Oncological Scientific Center, USSR Academy of Medical Sciences, Moscow; Institute of Spectroscopy, USSR AS, Troitsk

[Abstract] Comparative studies were conducted on the responses of nucleic acids to short, powerful bursts of  $\text{Nd}^{3+}$ -YAG lasers (266 nm,  $3 \times 10^{-11}$  pulses at 2 sec intervals) in proliferating and resting HeLa cells. Exposure of proliferating cells to 1 to 3 UV pulses 0.2 or 2.0 MW/cm<sup>2</sup> in intensity stimulated DNA synthesis, while ten pulses inhibited it. No stimulation occurred with high intensity pulses (20 MW/cm<sup>2</sup>). RNA stimulation was evident only a single 2 MW/cm<sup>2</sup> pulse, while other modalities of irradiation were without significant effect. In the proliferating cells, membrane permeability to <sup>3</sup>H-thymidine and <sup>14</sup>C-uridine remained unaffected. Irradiation of resting HeLa cells showed no effect on DNA synthesis, while RNA synthesis was stimulated only by 3 pulses 0.2 or 2.0 MW/cm<sup>2</sup> in intensity. Permeability to radiolabeled thymidine and uridine was also affected in a variable manner: exposure to 3 pulses increased permeability (maximum with 2.0 MW/cm<sup>2</sup>), while an increase in the number of pulses or intensity led to a decrease in permeability. Since three pulses were generally required to modify nucleic acid synthesis or alter

plasma membrane permeability to the precursor bases, and since each pulse had characteristics sufficient to elicit a photochemical change, it appears that the initial pulse served to initiate a priming event or events which facilitated subsequent laser-based changes. Figures 1; references 13: 5 Russian, 8 Western.

[1545-12172]

UDC 577.391;577.15

#### EFFECTS OF IONIZING RADIATION ON SUPEROXIDE DISMUTASE LEVELS AND TURNOVER IN RAT LIVER

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 3 Jan 83) pp 25-28

KOMOV, V. P. and IVANOVA, Ye. Yu., Leningrad Chemical Pharmaceutical Institute

[Abstract] Outbred male rats were employed to evaluate the effects of ionizing radiation (8 Gy x-ray dose, 0.88 Gy/min) on the cytosolic and mitochondrial superoxide dismutase (SD; EC 1.15.1.1) levels and turnover in the liver, in view of the putative radioprotective role of this enzyme. Using labeled anti-SD antibodies, SD synthesis was found to occur on both free and membrane-bound ribosomes, with the latter predominating in importance in unirradiated animals. Following irradiation, predominant synthetic activity was shown by the free ribosomes, presumably due to radiation-induced breakdown of the endoplasmic reticulum membranes. Irradiation also induced statistically significant decrease in SD activities in the cytosolic and mitochondrial fractions, potentiating the rate of SD degradation in the cytosolic fraction 1.8-fold and in the mitochondrial fraction 2.5-fold. A compensatory increase in the rate of SD synthesis was seen in both fractions (five-fold for mitochondria, 1.3-fold for cytosol). These observations indicate that ionizing irradiation interferes with dismutation of superoxide radicals, which would appear to potentiate the severity of radiation sickness. Figures 2; references 14 (Western).

[1545-12172]

UDC 577.391:611.41

#### RADIOSENSITIVITY OF PLURIPOTENT STEM CELLS DETERMINED BY SPLENIC CLONING IN IRRADIATED MICE

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 8 Dec 82) pp 39-43

POVERENNYI, A. M., SEMINA, O. V., SEMENETS, T. N., IVANOV, V. K. and SHAPOVALOVA, Ye. V., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] Radiobiologic characteristics of the murine stem cell population were studied in (CBA-C57Bl)<sub>1</sub>F<sub>1</sub> mice, by an analysis of the pattern of splenic colony formation in lethally irradiated mice (8.5 Gy gamma irradiation),

following injection of in vitro irradiated bone marrow cells. Evaluation of the dose-response pattern of the marrow cells showed that, in terms of colony formation, two inflection points were evident after treatment of the irradiated (0.04-3.7 Gy) cells with normal rabbit serum and anti-mouse brain serum (AMBS). These findings were interpreted to reflect two different populations of cells different in radiosensitivity in the original colony forming pool. The mean lethal dose ( $D_0$ ) after irradiation in the 0.04-0.75 Gy after treatment with NRS was 0.93 Gy, whereas after incubation with AMBS  $D_0$  was calculated at 0.33 Gy. Addition of thymic cells to the AMBS-treated cells linearizes the dose-response curve and shifts the  $D_0$  to 1.81 Gy. These observations indicate that the bone marrow population consists of cells heterogenous in terms of radiosusceptibility, and confirms the reported observations that thymocytes and thymic hormones may alter the radiosusceptibility and proliferating activities of other cells. Figures 1; references 12: 5 Russian, 7 Western.  
[1545-12172]

UDC 557.391:547.983.3

#### CHANGES IN THYMIDINE CLUSTERS IN THYMIC DNA IMMEDIATELY AFTER SUBLETHAL $\gamma$ -IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 12 Apr 82) pp 63-66

VETCHINKINA, A. A. and KRITSKIY, G. A., Institute of Biochemistry imeni A. N. Bakh, USSR Academy of Sciences, Moscow

[Abstract] Rabbits were employed in a study to determine the effects of 2 Gy  $\gamma$ -irradiation on thymidine clusters in thymic DNA, with analysis conducted in terms of isopleths (oligonucleotide fractions with identical number of nucleotide moieties in the chain). Within 5-10 min of irradiation the relative concentration of isopleths I and II increased significantly ( $p < 0.01$ ), and that of isopleths V ( $p < 0.01$ ) and VIII ( $p < 0.01$ ) decreased. Analysis of the isopleths in terms of their components showed a significant relative increase in  $C_2T_2$  ( $p < 0.01$ ), and a relative decrease in  $CT_3$  ( $P < 0.01$ ) and  $T_5$  ( $p < 0.05$ ). These findings indicate that gamma irradiation induced a decrease in the longer T-rich oligonucleotides and a relative increase in shorter T-rich pyrimidine fragments of DNA. Figures 1; references 4 (Russian).  
[1545-12172]

FAST NEUTRON AND  $\gamma$ -RAY INDUCED CHROMATIN BREAKDOWN IN RAT THYMUS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 3 Jan 83) pp 66-69

VODOLAZSKAYA, N. A., Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] Outbred and Wistar rats were used in a study on chromatin degradation in the thymus following irradiation with fast neutrons (1.5-2 MeV with 25-30% of dose due to  $\gamma$ -rays) or  $\gamma$ -irradiation (1 Gy/min), within a dose range of 0.25-11 Gy. Chromatin degradation showed a dose-dependent increase up to 4 Gy in both cases within 4-6 h, reaching a plateau level subsequently. The damage with the fast neutrons was more pronounced in terms of polydeoxynucleotide formation, and indicated their greater efficiency in inducing interphase death of cells. Up to a dose of 4 Gy, the RBE for neutrons ranged from 3.1 to 2, and fell to 1 within the 6-11 Gy range. Figures 1; references 8: 5 Russian, 3 Western.

[1545-12172]

EFFECTS OF NONUNIFORM  $\gamma$ -IRRADIATION ON RAT SERUM ENDONUCLEASE ACTIVITY

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 7 Dec 82) pp 71-73

KOLYUBAYEVA, S. N., NOVOSELOVA, G. S. and KOMAR, V. Ye., Central Scientific Research Roentgen-Radiological Institute, USSR Ministry of Health, Leningrad

[Abstract] To determine the extent to which serum enzymes may be involved in cell death following radiation injury, serum endonuclease activity at pH 5.75 was evaluated in rats subjected to nonuniform  $\gamma$ -irradiation with LD<sub>0</sub> and LD<sub>100/30</sub> doses craniocaudally and caudocranially (with a 3:1 and 5:1 nonuniform dose coefficients). Endonuclease activity was estimated from the degree of conversion of supercoiled plasmid DNA into an open ring form. The various doses of irradiation led to an increase in serum endonuclease activity to ca. 100% above baseline level, an increase which persisted for at least 24 h. There were no essential differences between craniocaudal or caudocranial irradiation. References 6: 5 Russian, 1 Western.

[1545-12172]

# ALTERED METABOLISM OF THYMOCYTIC PROTEIN FRACTIONS IN IRRADIATED RATS: ELECTROPHORETIC ANALYSIS AND DNA-INTERACTING PROTEINS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 21 Jul 82) pp 76-79

DOMASHENKO, A. D. and UMANSKIY, S. R., Institute of Biological Physics,  
USSR Academy of Sciences, Pushchino

[Abstract] Wistar rats were subjected to 8 Gy (68 MGy/sec)  $\gamma$ -irradiation to evaluate the effects of such treatment on thymocyte protein metabolism and, in particular, the fate of proteins interacting with DNA. Polyacrylamide gel analysis of the protein patterns of the cytoplasm and the nuclear sap showed that within the first 2h after irradiation there were no significant changes. However, a time-related decrease in the rate of synthesis of nonhistone chromatin proteins was noted in terms of proteins with a MW greater than 50,000. Elution patterns of DNA-affinity columns showed that inhibition of synthesis affected primarily proteins showing the strongest binding to DNA. It remains to be determined with certainty whether synthesis per se was primarily affected, or whether structural alterations in the proteins interfered with binding. Figures 2; references 12: 7 Russian, 5 Western.  
[1545-12172]

UDC 577.391

## RADIOMODIFYING EFFECTS OF 8-AZAHYPOXANTHINE

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 17 Feb 83) pp 90-92

VOLCHKOV, V. A. and MIKHAYLOVA, N. Ya., Central Scientific Research Roentgen-Radiological Institute, USSR Ministry of Health, Leningrad

[Abstract] The radiomodifying effects of 8-azahypoxanthine (8AHX) were tested on outbred and (CBA x C57Bl/6) $F_1$ , treated intraperitoneally with 100 mg/kg 8AHX, following x-irradiation with a single 6.0-8.5 Gy or fractionated (2 Gy x 5 or 3 Gy x 3 daily). The results were assessed in terms of survival and splenic colony-forming units in endocolonial methodology. Additionally, the effects of 8AHX were evaluated in terms of growth kinetics of implanted RL-67 tumor in the mice and survival of La leukemia cells. The summarized findings showed that 8AHX exerted a slight radiosensitizing effect as indicated by a repair index of  $4.2 \pm 1.02$  for the control mice and  $1.8 \pm 0.49$  for the experimental mice. Apparently, 8AHX interferes with postradiation repair mechanisms. Data on the transplantable tumor cells did not reveal significant differences between control and experimental animals. Figures 3; references 7 (Russian).  
[1545-12172]

## RADIOPROTECTIVE EFFECTS OF POLY(I):POLY(C)-MEXAMINE COMBINATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 24 Nov 82) pp 94-96

ZHUKOVA, N. A., Palyga, G. F., MAKSIMENKO, A. A. and VATSEK, A., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk; Institute of Biophysics, Czechoslovak Academy of Sciences, Brno

[Abstract] Lack of data on the efficacy of enhancers of natural immunity on effectiveness of the radioprotective agent mexamine (5-methoxytryptamine; MTA), led to an evaluation of poly(I):poly(C) (PIPC) and MTA pretreatment on the survival rate of 3-4 month old (CBA X C57Bl)<sub>F</sub><sub>1</sub> mice following 8-12 Gy gamma irradiation. Intraperitoneal administration of PIPC (2.5 mg/kg) 2 days before irradiation and MTA (30 mg/kg) 5 min before irradiation, was effective in extending the 30 day survival time in mice irradiated in the 9-12 Gy range. PIPC alone had no radioprotective effects, and in combination with MTA did not potentiate the toxicity of the latter. The effectiveness of the combination was largely due to a decrease in mortality during the intestinal phase of radiation sickness (days 3-5), without affecting the 'bone marrow' death phase (days 7-20). References 9 (Russian).  
[1545-12172]

UDC 539.163;599.323.4

## KINETICS OF AMERICIUM METABOLISM DURING LONG-TERM ADMINISTRATION IN RAT

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 8 Dec 81) pp 99-100

MOSKALEV, Yu. I. and ZALIKIN, G. A., Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] Americium accumulation and excretion kinetics were followed for a 300 day period in outbred rats injected subcutaneously with <sup>241</sup>Am chloride solution (925 Bq) on a daily basis (excluding weekends). During the first 8 days most of the radioisotope accumulated in the liver, but beginning with the second week the rate of hepatic accumulation diminished and skeletal accumulation was predominant. At the conclusion of the experiment (day 300) the relative multiplicity of accumulation of <sup>241</sup>Am was: liver--32, skeleton--31, spleen--0.24, kidneys--0.98, and lungs--0.14. Urinary and fecal elimination of <sup>241</sup>Am varied from 2.1 to 3.6% for each route over the period of administration. References 3 (Russian).  
[1545-12172]

EFFECTS OF INDOMETHACIN ON RECOVERY OF HEMOPOIESIS IN MICE AFTER WHOLE-BODY  $\gamma$ -IRRADIATION

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 17 Dec 82) pp 101-104

SKLOBOVSKAYA, I. E., ZHAVORONKOV, L. P. and DUBOVIK, B. V., Scientific Research Institute of Medical Radiology, USSR Academy of Medical Sciences, Obninsk

[Abstract] Since substances inhibiting prostaglandin synthesis have been shown to have hemostimulant properties [Sklobovskaya, IE, et al., Radiobiologiya, 24 (1):56-59, 1984], such studies have been extended to evaluate the hemopoietic effects of indomethacin (IMC), one of the most potent inhibitors of prostaglandin synthesis. Effects of IMC on hemopoietis were studied in (CBA x C57Bl)<sub>1</sub> mice subjected to 6 Gy gamma-irradiation and subsequently treated intragastrically for 5 days with IMC (6 mg/kg). One hour to 15 days after irradiation bone marrow cells were transplanted to 8 Gy gamma-irradiated recipients and splenic colony formation was monitored. The results showed that IMC accelerated recovery of hemopoiesis largely due to repopulation with surviving stem cells. Cell division was stimulated and logarithmic growth phase of the colony forming cells was seen 3.2 days earlier in the IMC-treated mice than in control mice. The earlier appearance in the peripheral blood of mature, formed elements may be a factor in altering the clinical manifestations of acute radiation sickness. Figures 1; references 5: 4 Russian, 1 Western. [1545-12172]

## EFFECTS OF HIGHLY DISPERSED IRON POWDER ON SURVIVAL OF IRRADIATED MICE

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 20 Feb 83) pp 104-106

FEDOROV, Yu. I., IVENENKO, G. F. and BURLAKOVA, Ye. B., Institute of Chemical Physics, USSR Academy of Sciences, Moscow

[Abstract] In view of the extensive damage sustained by various metallo-enzymes and metalloproteins in radiation sickness, SHK mice were treated with highly dispersed iron preparations (0.2-100 mg/kg) 20-30 min before 3.5-6.5 Gy irradiation from RUT-200-20-3 apparatus to determine potential effectiveness of such treatment in terms of survival time. Prior to subcutaneous administration, the iron suspension was sonicated for 5 min. Radioprotective effects were variable and dose- and radiation-dependent. Maximum 30 day survival (20-30%) was seen in animals subjected to 6.5 Gy after treatment with 1.5-1.8 mg/kg of the iron suspension. In addition, treatment with suspensions 5 mg/kg or greater in concentration exerted a slight radiosensitizing effect. Figures 2; references 15: 13 Russian, 2 Western. [1545-12172]



## POSTRADIATION RECOVERY OF SPERMATOGENOUS EPITHELIUM IN RODENTS AND HUMANS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 7 Dec 82) pp 107-110

TYAZHELOVA, V. G. and PLOTNIKOVA, G. A., Institute of Biological Physics,  
USSR Academy of Sciences, Pushchino

[Abstract] Experimentally derived data on the survival and recovery of spermatogenous epithelium in mice and rats were used to construct a table listing transit times for spermatogonia, spermatocytes, spermatids and sperm cells in animals subjected to various doses of irradiation. Other parameters included mitotic delay in relation to high and low doses of radiation and the duration of spermatogenesis, with the data serving to construct mathematical models describing recovery from radiation damage. Such information was then extrapolated to human males, and showed that the postradiation recovery kinetics of cell populations are not determined by absolute transit times, but by the lifetime of mature or final forms in the various cell pools. Best correlation between experimental and calculated plots was obtained when the transit times in all the pools of the spermatogenous epithelium was similar. Figures 1; references 13: 8 Russian, 5 Western.  
[1545-12172]

## POSTRADIATION DYNAMICS OF MOUSE BONE MARROW GRANULOCYTE/MACROPHAGE PRECURSOR CELLS CLONED IN AGAR DIFFUSION CHAMBERS

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 15 Jan 83) pp 110-113

KAPLAN, V. P., KOLESNIKOVA, A. I., KONOPLYANNIKOV, A. G. and LEPEKHINA, L. A.,  
Scientific Research Institute of Medical Radiology, USSR Academy of Medical  
Sciences, Obninsk

[Abstract] Agar diffusion chambers were used to study the postradiation cell kinetics of bone marrow cells of CBA mice after 4 Gy gamma-irradiation. Analysis of the data in terms of colony forming units revealed that cells capable of forming colonies underwent pronounced reduction in number in the 24 h postradiation period. Two days after irradiation, essentially normal counts were obtained, and baseline (control) counts were obtained by the 11th postradiation day. During the period of recovery the cells were much more susceptible to destruction by hydroxyurea, a characteristic feature of S-phase cells, indicating that the colony-forming cells were more like pluripotent stem cells than committed cells. Figures 1; references 13: 5 Russian, 8 Western.  
[1545-12172]

## GERM CELL DEATH AS INDICATOR OF RELATIVE BIOLOGICAL EFFECTIVENESS OF TRITIUM OXIDE

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 16 Feb 82) pp 114-117

BALONOV, M. I., KUDRITSKAYA, O. Yu. and BRUK, G. Ya., Scientific Research Institute of Radiation Hygiene, RSFSR Ministry of Health, Leningrad

[Abstract] Testicular weight served as the criterion for evaluating the RBE of tritium oxide (THO) relative to that of 0.66 MeV gamma-radiation in outbred 8-12 week old mice. The animals received a single intraperitoneal injection of THO to yield a testicular dose in the 0.12-3.4 Gy range. Exposure to a Cs-137 source yielded a gonadal dose in the 0.25-3.7 Gy range. A statistically significant loss of testicular weight after 30 days was seen in the  $D = 0.25$  Gy mice in comparison with control animals. At doses exceeding 2.0 Gy for THO or 3-4 Gy for gamma-radiation the ratio of testicular to body weight was ca. 35% less than the control value, with a subsequent decrease in the rate of atrophy of ca. ten-fold. The calculated RBE for THO was shown to be inversely related to the dose of beta-irradiation from THO, increasing from 1.8 at 1 Gy to 2.2-2.3 at 0.1 Gy. Consequently, the quality factor for tritium beta radiation was calculated at 2 rem/rad. Figures 1; references 8: 3 Russian, 5 Western.  
[1545-12172]

GENETIC EFFECTS OF  $^{14}\text{C}$  INCORPORATED INTO MOUSE MALE SEX CELLS:  
LONG-TERM AND CHRONIC ADMINISTRATION OF  $^{14}\text{C}$ -GLUCOSE

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 20 Sep 82) pp 117-119

RAMAYYA, L. K., POMERANTSEVA, M. D., VILKINA, G. A., SHEVCHENKO, V. A., VASILENKO, I. Ya., LAYGINSKAYA, A. M., ISTOMINA, A. G., TUROVA, V. I., OSIPOV, V. A. and SINITSINA, S. N., Institute of General Genetics, USSR Academy of Sciences, Moscow; Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] The effects of  $^{14}\text{C}$  radiation on male gonads was evaluated in terms of dominant lethal mutations (DLM), reciprocal translocations (RT), and anomalous sperm heads (ASH) in (CBA x C57Bl) $F_1$  mice.  $^{14}\text{C}$ -Glucose was administered per os to the mice for 33 days to yield a total gonadal dose of 0.74 or 1.47 Gy in the long-term studies. In chronic studies radioisotope was administered for 6 or 12 months to yield respective total doses of 0.006 or 0.031 Gy after 6 months, and 0.013 or 0.066 Gy after 12 months. Only the long-term animals showed a statistically significant increase in the incidence of

DLM, while chronic administration mice failed to do so in any of the experimental groups. Similarly, a significant increase in the incidence of RT was only seen in animals fed  $^{14}\text{C}$ -glucose for 33 days. On the other hand, an increase in the incidence of ASH was obtained only in the animals exposed to low irradiation for a period of one year. References 5: 3 Russian, 2 Western. [1545-12172]

UDC 577.391:616.001.28

ONCOGENIC EFFECTS IN RAT OF OSTEOTROPIC RADIONUCLIDES ALONE AND IN COMBINATION WITH  $^{131}\text{I}$

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 24 Nov 82) pp 120-122

ZHORNO, L. Ya. and IL'IN, B. N., Leningrad Scientific Research Institute of Radiation Hygiene, RSFSR Ministry of Health

[Abstract] Outbred albino rats were used to assess the oncogenic potential of Sr-90 (207 kBq/kg) or of Ca-45 (13 kBq/kg) following a single per os administration alone, or in combination with I-131 (3.7 kBq/kg). Histologic examination of the skeleton of animals surviving for 200 days or more showed that bony malignancies developed in 29.4% of the animals treated with Ca-45 alone. The corresponding figure for bone cancer was 60.3% in the animals treated with Sr-90. Animals treated with I-131 only had a 5.8% incidence of tumors among the 51 animals so treated, of which 2 cases consisted of benign bone tumors and one of thyroid adenocarcinoma. The incidence of bone malignancies in animals treated with the Ca-45/I-131 combination was 13.5%, and 15.4% in the Sr-90/I-131 animals. I-131 was, therefore, shown to significantly lower the incidence of malignancies induced either by Ca-45 or Sr-90. While the mechanism of action of iodine remains unclear in this respect, it may well have been due to an induction of hormonal imbalance. References 5 (Russian). [1545-12172]

UDC 577.391:612.014.482

BERKELIUM-249 METABOLISM

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 28 Feb 83) pp 122-125

ZALIKIN, G. A., MOSKALEV, Yu. I. and NISIMOV, P. G., Institute of Biophysics, USSR Ministry of Health, Moscow

[Abstract] The distribution and elimination of Bk-249 was studied in outbred albino rats following an intraperitoneal injection of a 250 kBq/kg dose. In analogy to other actinides, highest levels of this radionuclide accumulated in the skeleton (approaching 39.8% of the administered dose) and the liver (18.4%),

followed by the muscles (9.1%) and the skin (4.5%). The maximum skeletal levels were seen 8 days after administration; subsequently, the levels gradually decreased and the rate of decrease indicated a 500-600 day elimination halftime. Recalculation in terms of one gram of wet weight, at the different postinjection period of time, yielded the following highest concentrations reached in the various tissues: adrenals--7.3%, liver--3.2%, spleen--1.3%; bone--1.2%, and kidneys--1.1%. Measurements on the elimination of Bk-249 from the body during the first 30 days showed that 18.2% of the dose was excreted via the kidneys and 10.4% was eliminated via the enteral route. Figures 1; references 5: 3 Russian, 2 Western.  
[1545-12172]

UDC 577.391

EFFECTS OF INHALATION OF SUBMICRON  $^{239}\text{PuO}_2$  ON HEMODYNAMICS AND HEART MASS  
PARAMETERS IN DOG

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 28 Feb 83) pp 126-129

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[Abstract] Comparative studies were conducted on hemodynamic and cardiac parameters with respect to age in control dogs and dogs subjected to inhalation of alpha-particle emitting  $^{239}\text{PuO}_2$  particles 0.065 mcm in diameter for various periods of time (2 weeks to 8 years). The control animals exhibited age-related changes in the hemodynamic and cardiac parameters, which commenced at about the age of 6-7 years. The arterial BP rose from ca. 150 mmHg to ca. 173 mmHg by the age of 9-10 years, along with a concomitant gradual decrease in the venous blood pressure to ca. 14.5 mm H<sub>2</sub>O toward the end of life. These changes were interpreted as indicating a normal compensatory response to age-related increase in pulmonary resistance. Such changes were much more pronounced in the  $^{239}\text{PuO}_2$ -treated dogs and had an earlier onset directly related to the radiation dose. The more extensive radiation-induced damage of the pulmonary capillaries resulted in the onset of cor pulmonale and the development of cardiomegaly. References 11 (Russian).  
[1545-12172]

# BEHAVIOR AND BIOLOGICAL EFFECTS OF $^{239}\text{Pu}$ ON INTRAMUSCULAR ADMINISTRATION IN CONJUNCTION WITH CHELATION THERAPY

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 21 Sep 82) pp 129-132

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[Abstract] The oncologic consequences of intramuscular injection of Pu-239 nitrate (I) and Pu-239 citrate polymer (II) were evaluated in Wistar rats, as well as the therapeutic effectiveness of Pu-binding chelating agent pentacin. As expected, with I the radionuclide levels in the skeleton were higher than with II, while with II the radionuclide levels at the site of injection remained higher due to the slower release of the polymer from its depot. In conjunction with this, the incidence of osteosarcoma was higher with the injection of I than with II, while development of fibrosarcomas at the site of injection was higher with II than with I. Administration of pentacin (intraperitoneally, 25 micromoles per kg per day, 5 times per week during 64 calendar days) prolonged the survival time of animals injected with I (ca. 494.5 days) to a significant degree (ca. 609 days), but was somewhat less effective in this respect in animals injected with II (ca. 596.8 vs. 649.0 days). Pentacin treatment was also effective in reducing the skeletal load of the radionuclide 2.5-fold, the incidence of osteosarcomas 1.6-fold in the I studies, and 2.6-fold in the II studies. References 11: 9 Russian, 2 Western. [1545-12172]

UDC 577.391:621.039.58

## COLCHICINE MECHANISM OF ACTION IN RADIOSENSITIVITY

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 6 Nov 81) p 137

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[Abstract] Administration of colchicine to animals 15 min prior to irradiation potentiates damage to the hemopoietic system and accelerates death due to summation of its cytostatic effects. However, if irradiation is delayed for 3 days and the stimulant action and colchicine on the hemopoietic system becomes the predominant factor, colchicine improves postradiation recovery and the 30 day survival figures. This article has been deposited with VINITI, No 5673-83Dep, 17 Oct 83. [1545-12172]

## RADIOPROTECTIVE EFFECTIVENESS OF CERTAIN IMIDAZOLE AND IMIDAZOLINE DERIVATIVES

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 21 May 82) p 138

ZNAMENSKIY, V. V., BEKETOV, V. P., YEVDKOV, V. P. and ZHEREBCHENKO, P. G.,  
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[Abstract] Various derivatives of imidazole and imidazoline were tested on (CBA x C57Bl) $F_1$  mice for radioprotective effects. Certain such compounds were found to be highly effective within a wide dose range and when administered by a number of routes; the structure-activity relationships were determined for such agents. Combined administration of effective imidazoline derivatives with certain surfactants led to a significant increase in the survival rate of the irradiated animals. This article has been deposited with VINITI, No 5678-83Dep, 17 Oct 83.  
[1545-12172]

RESPIRATORY EFFECTS IN DOGS FROM EXTERNAL GAMMA-IRRADIATION AND INHALATION OF SUBMICRON  $^{239}\text{PuO}_2$  PARTICLES

Moscow RADIOBIOLOGIYA in Russian Vol 24, No 1, Jan-Feb 84  
(manuscript received 16 Oct 81) p 138

KALMYKOVA, Z. I., BULDAKOV, L. A., KHARUNZHIN, V. V. and FETISOVA, L. I.,  
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[Abstract] Exposure of dogs to a combination of external gamma-irradiation (25.8-103.2 mkr/kg exposure doses) in combination with inhalation of submicron  $^{239}\text{PuO}_2$  particles was seen to alleviate respiratory insufficiency developing with  $^{239}\text{PuO}_2$  alone. However, the overall clinical deterioration of the animals was exacerbated, and the survival time shortened in many cases. This article has been deposited with VINITI, No 5679-83Dep, 17 Oct 83.  
[1545-12172]

## VETERINARY MEDICINE

### VETERINARY ASPECTS OF SWINE BREEDING

Moscow SVINOVODSTVO in Russian No 4, Apr 84 pp 10-12

[Article\* by N. Khoroshilov, chief of Veterinary Department, USSR Main Administration for Livestock Products]

[Text] The industrialization of livestock farming poses new tasks with regard to planning, constructing and operating swine-breeding facilities, breeding work, feed production, formation and upkeep of herds, implementation of therapeutic-preventive and economic-organizational measures.

Industrial technology is based on efficient and well-organized operation of all services, as well as high sophistication of production. Under such conditions, the role of the veterinary service increases significantly, and its tasks become more difficult and responsible.

The veterinary worker, like any specialist at the complex, must not only be very proficient with respect to special knowledge within the limits of a given branch of the livestock industry, but have a good idea about the technology and system of organization of an enterprise; he must be well-informed about all structural elements of the complex, use them competently to solve any problems that arise, and be proficient in relating measures to protect animals against diseases to the work of other specialists, he must strive along with the entire team for high production indicators and improvement of economic effectiveness of the enterprise.

It is known that, all other conditions being equal, only healthy animals can yield a maximum amount of high-grade products; for this reason, a properly organized system of veterinary and sanitary measures, all elements of which should form a single chain, is a prerequisite of paramount importance for the wellbeing of the herd with regard to infectious disease, with increase in its productivity and economic effectiveness of production.

A reliable system of veterinary and sanitary protection of animals from infectious diseases could be developed only if one adheres to veterinary rules and requirements in planning and building complexes.

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\*Paper delivered at a seminar which convened in Krasnoyarsk in November 1983 and dealt with swine breeding in Siberia and the Far East.

It is imperative to have plans for and build veterinary and sanitary facilities: quarantine and disinfection-washing rooms, disinfection units, slaughtering rooms and others. When building complexes, these installations must be started up first.

For successful operation and achievement of planned production indicators, a high quality of building and installation work is needed. Slippery floors, jagged and dented wire flooring, inconsistency of gaps between wire flooring strips with the plans and other building flaws lead to significant traumatism among swine.

Studies have shown that deviations in parameters of lighting conditions and microclimate from the zoohygienic requirements also have an adverse effect on animal productivity.

Constant veterinary supervision of construction and installation of equipment makes it possible to eliminate in good time the above deficiencies and subsequently obtain better results in disease prevention, preservation and productivity of the herd.

Animals must be installed in the complexes with great responsibility and adherence to the guidelines. There should be stricter screening of swine, submitting them to diagnostic tests at the supplier farms, as well as preventive inoculations and treatment, with establishment of an appropriate veterinary department in the oblast, kray or republic on the basis of the rules recommended by the Main Veterinary Administration of the USSR Ministry of Agriculture and existing epizootic situation.

The female parent stock and sires must first pass through quarantine, where they are submitted to diagnostic tests and treatment against diseases and ectoparasites for 1 month, and only after this are the animals placed in the main production facilities of the complex.

Stock being fattened up must also be thoroughly checked at supplier farms for infectious diseases, inoculations and treatment, and it should be received in rooms prepared in advance. Each room should be filled at the same time.

When the technology of feeding, upkeep is not properly adhered to and veterinary rules are not followed, not only noncommunicable, but infectious diseases may occur at swine-breeding complexes.

Among the noncommunicable diseases, the most frequently recorded are diseases of digestive organs, which appear when feed is used that does not meet the existing requirements.

Diseases of respiratory organs appear where specified microclimate parameters are not provided.

The greatest loss of young stock can occur at complexes where metritis and mastitis develop and, consequently, agalactia of sows. There are several causes involved, but the chief ones are infractions referable to feeding and upkeep, as well as maternal genetic factors.



Use of oxitocin, neomycin, lefuran or a preparation consisting of norsulfazole, hexamethylene tetramine, sodium benzoate caffeine dissolved in water for post-partum diseases (mastitis, endometritis) yields an insignificant therapeutic response. One must rely on prevention rather than treatment. It is imperative to reject sows that are unsuitable for reproduction.

Early weaning and lack of "infant" feed (starter and prestarter feed--SK-3 and SK-4) at some complexes also affect piglet morbidity and survival. In this case, prevention of diseases and loss of piglets consists of eliminating these causes.

Absence of vitamins, macroelements and trace elements from feed also leads to animal diseases and economic losses. Vitamin D deficiency is one of the causes of rickets and tetanus in piglets and osteomalacia in adult animals. Constant use of ultraviolet lamps is necessary to enhance conversion of provitamin D<sub>3</sub>, which is contained in the skin, into the active form of vitamin D<sub>3</sub>. It is very regrettable that proper attention is not given to ultraviolet light in all cases or all places.

A low level or absence of zinc in feed causes parakeratosis in animals, which gives much trouble and concern to veterinary workers, while a vitamin E deficiency leads to barrenness of sows. Absence of lysine in feed retards growth and development of piglets.

In such cases, constant and thorough monitoring is required of the quality of feed that is used, which is allowed in different regions of the country, so that the results of work are also different. It is imperative to accurately fulfill the joint order of the USSR Ministry of Agriculture and USSR Ministry of Procurement concerning the checking of quality of produced feed.

In this regard, the laboratories of the Complex imeni 60th Anniversary of BSSR and the neighboring mixed feed plant are performing well. They solve all problems that arise immediately and well.

The "Industrial" Complex makes efficient use of the State Board of Arbitration. After some healthy fines were imposed, there was considerable improvement of the quality of mixed feed.

Poor technology of feeding and upkeep leads to weakening of the organism, decrease in its resistance and onset of colibacteriosis, viral gastroenteritis, etc. Under such conditions, inoculations against these diseases are needed. Among the numerous vaccines against transmissible gastroenteritis, the one from GDR is the most effective. Use of antibiotics, sulfanilamides or other drugs does not yield positive results.

A production experiment was conducted at one of the farms because of occurrence of this disease. A group of pregnant sows was divided into two parts. One was left in the complex and the other was transferred to summer camps. There were virtually no cases of sickness or death among piglets at the summer camps, whereas in the remaining sows the disease was found and there were considerable deaths of young stock. There is only one conclusion: solar rays, good air and greengrass played their beneficial role.

Chief veterinarian N. Kh. Zasepskiy, together with scientists, developed and are using with success allogenic immune swine serum for prevention of gastrointestinal diseases caused by diverse conditionally pathogenic and toxicogenic microflora at the Krasnogorskiy Complex in Chelyabinsk Oblast. This serum is prepared from blood drawn from donor animals at the complex. Its trial use was approved by the Scientific and Technical Council of the USSR Ministry of Agriculture.

Edematous disease of piglets is recorded occasionally at some complexes. Its severity and duration depend on many factors, but primarily on weaning time and method, feeding conditions in the preweaning and postweaning periods.

The steps for control and prevention of this disease include proper and diversified feeding of sows, early and gradual adjustment of piglets to feed supplements, limited feeding after weaning, use of a drug mixture: 5 kg sugar, 60 g biomycin hydrochloride, 40 g furazolidone, 200 g sulfadimesine, 20 g copper sulfate and 10 g tylan (farmazin) per 100 kg feed. The mixture is given daily for 8 days after weaning. Of the antibiotics, neomycin yields the best effect.

At the Complex imeni 60th Anniversary of BSSR, a drug mixture consisting of furazolidone, sulfadimesine, iron glycerophosphate, vitamin U and multiple vitamins is added to the feed of piglets (from the 2d to 8th postweaning day) to prevent enteritis.

The veterinary specialists of swine-breeding complexes have long-since observed that the piglets of some sows kept under identical conditions and inseminated by the same sires do not suffer from gastrointestinal diseases. The Ukrainian Veterinary Scientific Research Institute and other institutes are working on this problem. The scientists have proposed a method, the tests of which consider three main groups of indicators for sows and boars.

1. Determination of phenotypic genetic characters for viability of piglets, their morbidity in suckling period and yield of piglets after weaning.
2. Indicators of blood resistance referable to hemoglobin, red cells, lymphocytes, total protein, reserve alkalinity, calcium, phosphorus, sugar, etc.
3. Bactericidal activity of blood serum and phagocytosis are taken into consideration.

These and other parameters are considered; the animals are evaluated with a grade.

Sows and boars are already being selected according to their natural resistance using the method of the above-mentioned scientists at several complexes in the Ukraine. This has yielded perceptible results at the Prikarpat'skoye Complex in Ivano-Frankovsk Oblast and Kalitvanskiy Complex in Kiev Oblast, as well as others.

These and other veterinary measures must be planned. There must be long-term and current plans. Errors in planning epizootic-control measures,

particularly when delivered stock is quarantined, could lead to outbreaks of infectious diseases.

For this reason, when stock is quarantined, it is mandatory to check it for leptospirosis, tuberculosis, brucellosis, listeriosis and, if necessary, for balantidiasis and antibodies to viral gastroenteritis.

Considering the major economic ties between complexes and other enterprises, swine must be inoculated against plague, erysipelas, Aujeszky's disease and, in some cases, leptospirosis, colibacteriosis and other infections.

The program for inoculations and diagnostic tests cannot be the same for all farms in different parts of the country. Many factors must be taken into consideration and, first of all, the epizootic situation in a given locality.

It should be stated that the combined immunization of swine previously used against erysipelas, plague and Aujeszky's disease by the Veterinary Administration of the USSR Ministry of Agriculture is now prohibited. Experience has shown that the swine inoculated against plague did not have the required immunity.

The scientists at the All-Union Scientific Research Institute of Veterinary Virology and Microbiology have proposed the LK vaccine against classical swine plague, as well as highly effective methods of using it. By following the recommendations of scientists at the above-mentioned institute, the specialists of the USSR Main Administration for Livestock Products and Kuybyshev Oblast Administration of Agriculture prepared and successfully used a plan of epizootic-control measures for the Povolzhskoye Experimental Production Association. The vaccine is given intramuscularly to boars and sows. Stock that is being fattened is inoculated by the aerosol method. Good results have been obtained with intake of the LK vaccine by mouth. Introduction of these measures has yielded significant economic effectiveness.

In Belorussia, aerosol vaccination of swine against plague, erysipelas and Aujeszky's disease has also been well-used at some swine-breeding complexes. Studies have shown that the intensity of immunity persists at an adequate level for 230 days.

Use of vaccines without appropriate veterinary-sanitary and economic-organizational measures cannot yield the desired result. For this reason, mechanical cleaning and disinfection must be performed in strict accordance to the technology, with adherence to specified times.

Rodent control is an important measure. Various extermination methods can be used for this purpose: food and water bait, spraying and toxic foam. Various anticoagulants serve as extermination agents, but zoocoumarin, retindan or fentolacin are best of all. All of them yield rather good results.

Veterinary specialists and practical workers contribute much effort and resources to the prevention of diseases, implementation of therapeutic and sanitary measures, and they achieve rather good results. Preservation of stock at complexes of our country is higher than in any highly developed country.

This does not mean that we have solved the problem of disease prevention and loss of animals. We must constantly search for reserves and make utmost use of them. Science must provide much help in this.

Industry expects more sophisticated plans for swine-breeding complexes from science, and they must provide for exercise for sows, not only pregnant ones but also nursing ones. It is imperative to include in the technology the use of succulent and other feed that affects milk content of sows and health of piglets. Equipment, apparatus for air intake and exhaust, as well as heating systems require improvement.

Veterinarians and zootechnicians of complexes need simple and efficient express methods for evaluating the quality of various types of feed, express methods of diagnosing diseases such as dysentery, brucellosis, tuberculosis, Aujeszky's disease, viral gastroenteritis, etc., as well as better methods of administering vaccines and drugs, simple and readily available methods of determining intensity of immunity in animals after giving them various vaccines.

The farm specialists are waiting for recommendations on checking the biological activity of vaccines and sera after they have been transported and stored for long periods of time under different conditions with regard to temperature and humidity.

We should also mention that disinfection equipment and instruments for veterinary treatment also require further refinement.

When these and several other problems are solved, the work of veterinary workers will be facilitated and its efficiency improved.

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CSO: 1840/1070

## HEMOPHILUS-CAUSED SWINE PLEUROPNEUMONIA

Moscow SVINOVODSTVO in Russian No 4, Apr 84 PP 14-15

[Article\* by M. Sidorov, professor at Moscow Technological Institute of the Meat and Dairy Industry]

[Text] Hemophilus-caused pleuropneumonia of swine is an infectious and contagious disease characterized by hemorrhagic pneumonia and fibrinous pleurisy. The disease causes great economic loss to swine-breeding farms.

Swine pleuropneumonia was first described in 1961 in Sweden, by Biberstein and Cameron. That same year, Matthews and Pattison of Great Britain isolated the pathogen of this disease, and in 1963 this was done by Olander from California. The disease was described in detail by Shop, from Argentina, in 1964 and by Nikolet et al., from Switzerland, in 1968. In subsequent years, the disease was recorded in countries with intensive swine breeding.

We (M. A. Sidorov, D. I. Skorodumov, N. I. Lavrent'yev) observed acute outbreaks of a respiratory disease in swine, which is typical of pleuropneumonia, at one of the swine-breeding complexes where 216,000 swine are fattened per year. At first, there were isolated outbreaks of pleuropneumonia (in 1977) among animals in the first half of the fattening period, then in a group being additionally fattened (26-106 days). Subsequently, the disease struck a large number of susceptible groups of swine. In 1979-1980, the etiology of this disease was definitively established.

The pathogen of pleuropneumonia (*Hemophilus pleuropneumoniae*) is a small, Gram-negative, nonmotile, capsule-forming coccobacterium with marked tropism for pulmonary tissue. For growth on artificial synthetic media it requires a special growth factor (U factor), which is contained in blood and tissues of animals, yeast extract and products of vital functions of some bacterial species. It causes hemolysis of red blood cells of different animals and has a surface antigen identified as a capsular polysaccharide. Blood or chocolate agar with a feeder bacteria is the most suitable medium for cultivating it.

Laboratory animals are not susceptible to various routes of infection. A high dose of culture leads to their death within a few hours due to toxicosis. At

\*Paper delivered at a seminar which convened in Krasnoyarsk in November 1983 and dealt with swine breeding in Siberia and the Far East.

the present time we know of six serotypes of the pathogen, which are differentiated in the agglutination and complement fixation tests. Their geographic distribution is heterogeneous.

Sick, recovered and bacterium-carrying specimens are the source of the pathogen of this infection. Infection can spread mechanically and through the air. It has been established that, after an epizootic exacerbation, the disease occurs in a discrete form. As a result, clinically healthy animals that are carriers of the pathogen (mainly in the tonsils) cause a continuous process of onset and spread of the disease when they come to other farms.

Infection is aerogenic. It spreads rapidly in rooms with high dust content when using dry, finely ground feed for the animals. Environmental factors have a significant effect on the course of infection: transportation, movement, mixing groups of different ages, low temperature in the sectors, fluctuations of daytime and nighttime temperatures, high degree of bacterial contamination, intensive exchange of air, air recirculation, etc.

The disease is manifested primarily in piglets 20-25 days after they are weaned, i.e., at over 45 days of age, and among the groups 3.5-6 months old. Constant addition to the sectors of susceptible groups of animals kept the incidence of pleuropneumonia on a high level, while placement in the sectors of piglets of different ages and from different production sections aggravated the course of infection. Mortality ranged from 9 to 90%, depending on the conditions and course of the disease. Maximum deaths were noted among piglets 80-95 days old (27, 24%).

The incubation period lasted 1 to 2 days, but only a few hours in the case of superacute course. We observed acute, superacute, subacute and chronic course, and the superacute course was noted at the start of acute outbreaks.

The infection was characterized by a serious general condition, it was associated with fever, lack of appetite, occasionally vomiting, sudden appearance of dyspnea, cyanosis of the integument and depressed cough. Shortly before death, sick animals produced bloody, slightly foamy secretions from the nose. There were cases of sudden death. With the subacute form of disease, death occurred within 5-24 h after appearance of the first clinical signs.

With acute course, there was prevalence of symptoms of pneumonia with constant fever. The sick animals presented dyspnea, cough, poor appetite and secretion of bloody foamy fluid from the nose in the agonal state. Most of the time, the sick swine would lie on their side near a wall. There was marked variation of severity of infection in different animals. Without treatment, death occurred within 2-5 days. Acute and superacute courses were more often found among well-nourished piglets.

With the subacute course, there was remittant fever, heavy breathing, periodic dry cough and poor appetite. The disease lasted 6 to 15 days. The chronic course was characterized by brief elevation of body temperature, periodic dry cough (more often in the mornings) and poor appetite. Such animals showed retarded growth, became anemic and they were often submitted to compulsory slaughtering. Exacerbation of infection is possible when the course is subacute or chronic.



Necropsy of piglets that died of pleuropneumonia revealed that the main changes occurred in the lungs. External examination of animals that died of superacute and acute infection revealed well-visible cyanosis of the skin of the ears, lower part of the head, neck and abdomen, as well as noticeable profuse secretion of bloody liquid from the nose.

An accumulation of blood fluid (up to 50-200 ml) was found in the chest of animals that died of acute pleuropneumonia, with unilateral or bilateral hemorrhagic inflammation of the lungs. Primarily the diaphragmatic lobes were stricken, unlike enzootic pneumonia. These parts of the lungs were compact, dark red and protruded slightly above the surface of lung tissue. There was profuse flow of bloody fluid from the surface of the incision in such areas. Accumulation of similar fluid was observed in the trachea and bronchi. Bronchial and mediastinal lymph nodes were enlarged and hyperemic. The stomach contained food masses. The mucosa of the small intestine and stomach revealed catarrhal-hemorrhagic inflammation.

With the subacute form, we found hemorrhagic pneumonia in one or several lobes of the lungs and fibrinous pleurisy with deposits in the form of grayish-yellow film. Adhesions were formed in the sites of pleural inflammation. The involved parts of the lungs were compact, ridged and unevenly colored (from dark red to grayish-brown). In the incision, there was noticeable alternation of compact foci differing in color and form. Mediastinal and bronchial lymph nodes were enlarged and red. The stomach was usually empty or contained a small amount of yellowish mucus. The mucosa of the stomach and small intestine revealed catarrhal inflammation. Pericarditis was seen in some animals.

The chronic course was characterized by focal, necrotic pneumonia and focal pleurisy with adhesions to the costal pleura. Upon dissection of encapsulated foci, grayish-yellow necrotic tissue was found in their cavity. With the reorganization of some foci, there were irregular-shaped cicatrices visible. The regional lymph nodes were insufficiently enlarged.

The diagnosis was made on the basis of epizootiological and clinical data, as well as results of necropsy of animals that had died or had to be slaughtered with subsequent performance of laboratory tests. The extreme contagiousness, involvement of animals referable to specific age groups, high mortality when the form was acute, typical signs of acute respiratory syndrome, presence of hemorrhagic pneumonia and fibrinous pleurisy offer convincing grounds for the diagnosis of Hemophilus-caused pleuropneumonia of swine. Pathological material (pieces of involved lungs, mediastinal and bronchial lymph nodes from animals that died or were destroyed) was sent to the laboratory for confirmation of the diagnosis. Pieces of lung were excised on the boundary between involved and healthy tissue.

The laboratory tests consisted of microscopy of impression smears, isolation of pure culture and its identification. Impression smears from involved lungs and lymph nodes were stained according to Gram and by the (Ginsa) [typo for Giemsa?] method and then examined under a microscope. In smears, the pathogen of pleuropneumonia had the appearance of small, Gram-negative coccobacteria and short rods invested in a capsule.

Cultures were inoculated on blood, chocolate agar and BEA [beef-extract agar] with a "feeder" bacterium. The cultures were incubated at 37°C for 24 h. Cultures of Gram-negative, hemolytic coccobacteria with urease activity, which grew on chocolate agar, formed satellite colonies on BEA with feeder bacterium, but did not grow on beef-extract broth or BEA without feeder were identified as the pathogen of pleuropneumonia.

Various antimicrobial preparations were used to treat sick young pigs, among which the most effective were antibiotics--penicillin, dibiomycin, tetracycline, bicillin-3 and others. Good results were obtained in 1979-1980 with use of long-acting antibiotics recommended by the All-Union Institute of Experimental Veterinary Science. They were given by intramuscular injection once every 3 days in a dosage of 0.5-0.7 ml/kg body weight. Intensive antibiotic therapy for 3-5 days was effective only at the start of the disease.

In addition to antibiotics, nonspecific polyglobulin prepared from the blood of swine at the complex that were being fattened, in the form of 2-3 intramuscular injections at the rate of 1 ml/kg weight, was used for therapeutic and preventive purposes, with subsequent administration of antibiotics at different times.

Treatment of swine suffering from pleuropneumonia is a time-consuming and expensive procedure, which led only to reduction of animal deaths, but did not lower morbidity. It is imperative to develop means of specific prophylaxis.

When Hemophilus-caused pleuropneumonia cases appear, it is forbidden to regroup animals. Separate service personnel are assigned to sectors with this disease. The animals are submitted to a clinical examination daily, and sick ones are isolated in separate pens. If the disease strikes more than 30% of the pigs, they are not isolated and the sick ones are treated, and a good microclimate is provided in the areas where they are kept.

Prevention of pleuropneumonia is based on strict adherence to the technology for raising, veterinary and sanitary rules, with a ban on sale of animals from farms that have a problem with this disease. When new stock is added to the sectors, they must be filled with pigs of the same age (at the same time). Animals from different production sections cannot be mixed in the same sector.

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